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EFFECTS OF RESIDUAL ORGANIC MATTER ON ELEMENTAL ANALYSES BY SPARK SOURCE MASS SPECTROGRAPHY (SSMS)

by

K. T. McGregor, B. M. Myatt, R. F. Clark,
D. E. Bause, and Charles Rutkowski

GCA/Technology Division
213 Burlington Road
Bedford, Massachusetts 01730

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EPA Project Officer: Frank E. Briden

Air and Energy Engineering Research Laboratory
Research Triangle Park, North Carolina 27711

AIR AND ENERGY ENGINEERING RESEARCH LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

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16. ABSTRACT

The report gives results of research to define the effect of organics in SSMS and to evaluate several sample preparation methods for their removal. Samples of known organic content were fabricated by diluting NBS SRM 1633 fly ash (spiked with several trace elements) with a mixture of organic compounds. Samples containing 0, 10, 50, and 90 percent organic material were developed. These fabricated samples and NBS SRM 1632 coal were analyzed by three laboratories using SSMS without prior pretreatment (neat) and after processing by several preparation procedures. The effects of organic material on neat SSMS analysis were assessed for the various concentration levels. Samples containing < or = 50 percent organic material could be successfully analyzed by SSMS without pretreatment. Difficulties were encountered with 90 percent organics. Four preparation procedures (Parr oxygen bomb, HF bomb, low temperature ashing, and mineral acid extraction) were evaluated for removal of organic interference and maintenance of sample integrity for SSMS, AAS (primarily Hg), and ICP analyses. Conclusions were drawn regarding their suitability for use in the Level 1 and/or 2 analysis schemes and the benefits of further research.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
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Chemical Analysis	Stationary Sources	07D
Spectrographs	Spark Source Mass Spectrography	14B
Spectroscopy		
Organic Compounds		07C

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ABSTRACT

Samples of known organic content were fabricated by diluting NBS SRM 1633 fly ash with a mixture of organic compounds. The SRM 1633 fly ash was spiked with several trace elements prior to this mixing. Samples containing 0 percent, 10 percent, 50 percent and 90 percent organic material were developed. These fabricated samples and NBS SRM 1632 coal were analyzed by three laboratories using SSMS without prior pretreatment (neat) and after processing by several preparation procedures. The effects or organic material on neat SSMS analysis were assessed for the various concentration levels. Samples containing $\leq$50 percent organic material could be successfully analysed by SSMS without pretreatment. Difficulties were encountered with 90 percent organics. Four preparation procedures (Parr oxygen bomb, HF bomb, low temperature ashing, and mineral acid extraction) were evaluated for removal of organic interference and maintenance of sample integrity for SSMS, AAS (primary Hg), and ICP analyses. Conclusions were drawn regarding their suitability for use in the Level 1 and/or Level 2 analysis schemes and the need for further research.

CONTENTS

Abstract. iii
Figures vi
Tables. vii
Acknowledgment. ix

1. Introduction. 1
2. Conclusions and Recommendations 3
3. Background. 5
    Principles of SSMS 5
    Data Interpretation and Quantitation 8
    Interference by Organic Material 15
4. Experimental Procedures 17
    Fabrication of Test Samples. 17
    Sample Preparation 18
5. Results and Discussion. 30
    Effect of Organics on Neat SSMS Analyses 31
    Effectiveness of Preparation Methods 31

References. 35

Appendices

A. JEOL-01BM-2 SSMS Specifications 64
B. Tabulated Raw Data from Laboratories A, B, and C. 67
C. Accuracy Analysis of Data 180

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FIGURES

Number		Page
1	Ion optics of a double-focusing spark source mass spectrometer with Mattauch-Herzog geometry.	6
2	Diagram of a spark source mass spectrometer.	7
3	Characteristic curve--optical density vs. log of exposure. . .	9
4	Results for all laboratories on the 0 percent organic sample .	37
5	Laboratory B results on the 0 percent, 10 percent, and 50 percent organic samples.	38

TABLES

Number		Page
1	Percent Abundances of Elemental Isotopes.	11
2	Relative Sensitivity Factors.	13
3	Linewidth Correction Factors.	14
4	Materials for NBS Fly Ash (SRM 1633).	19
5	Preparation of Spiked NBS Fly Ash	20
6	Theoretical Values for NBS SRM 1633 Fly Ash Including Spiked Elements.	21
7	Preparation of Organic Mixture.	22
8	Summary of Data Collection.	26
9	Experimental Parameters for Spark Source Mass Spectrometer Operation	27
10	Photoplate Exposure Scheme.	29
11	Summary of Low Temperature Ashing Data.	33
12	Elemental Results on NBS SRM 1633 Fly Ash Prepared by the AE Procedure	35
13	Accuracy Analysis on 0 Percent Organic Samples.	39
14	Accuracy Analysis on 10 Percent Organic Samples	42
15	Accuracy Analysis on 50 Percent Organic Samples	45
16	Accuracy Analysis on 90 Percent and 50 Percent Organic.	48
17	Comparison of Accuracy Analysis Data.	51
18	SSMS Results on Oxygen Bombed 90 Percent Organic Sample	52

TABLES (continued)

Number Page

19 Elemental Accuracy Data Summary No. +/No. - 54

20 Summary of AAS Results for Parr Bombed Samples. 57

21 SSMS Results on Prepared NBS SRM 1632 Coal. 58

22 Analysis of NBS SRM 1632a Coal-Averages of AAS and ICP Values . 59

23 AAS Data for NBS Coal Fly Ash (SRM 1633), Using HFB Preparation 60

24 Elemental Analysis Methods. 61

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SECTION 1

INTRODUCTION

A three-phased approach to the Environmental Assessment (EA) of stationary sources has been developed by IERL/RTP.[1*] The first phase, Level 1, is devoted to comprehensiveness and employs broad survey techniques to define the hazard potential of source emissions and to identify possible control needs. Level 2 seeks more specific elemental composition and compound identification information, while Level 3 uses process and control monitoring to define temporal variation of source emissions. Although the Level 1 sampling and analytical scheme has been used for several years by the EPA and its contractors, questions still exist regarding the performance of the techniques in meeting Level 1 criteria of precision and accuracy. In fact, such questions have arisen from review of data thus far obtained in Level 1 EAs.

Of particular concern is the multielement analytical technique, spark source mass spectrography (SSMS), used for Level 1 elemental surveys. SSMS can determine 70 elements simultaneously with an accuracy (combined with sampling accuracy) of a factor of 2 or 3. These are the criteria set for Level 1 environmental assessment measurements. In the conduct of Level 1 studies, however, questions arose as to whether such limits could be achieved for all of the elements measured in all of the sample matrices encountered in stationary source assessments. The effect of organic matter on SSMS analyses and whether interference of such organic matter could be eliminated by various sample preparation techniques was unknown, but adverse effects were suspected.

A research program was designed and conducted in an attempt to define the effect of organics on SSMS and to evaluate several sample preparation methods for their removal. National Bureau of Standards (NBS) standard reference materials (SRMs) were chosen as base samples for these experiments because they are well-characterized for a number of trace elements. SRM 1633 (fly ash) was diluted with an organic compound mixture to simulate combustion samples containing different amounts of organic matter. In addition, several elements were spiked into the SRM-organic samples to provide a greater number of elements of known concentration and also to disguise the NBS samples from the analytical laboratories. SRM 1632 (coal) was also used for several experiments. Fabricated samples were submitted to three laboratories for preparation by several methods and analysis by SSMS. Intralaboratory and interlaboratory results were compared for each sample. The effects of organics on SSMS and their removal by the preparation methods were assessed.

(*) Now, the Air and Energy Engineering Research Laboratory.

In addition, the utilities of the methods as preparation techniques for atomic absorption spectrometry (AAS) measurements, principally mercury (Hg), were also studied.

Results of the experimental program are presented and discussed in Section 5. Procedures used to fabricate test samples and the preparation and analysis procedures used in the study are delineated in Section 4. The principles of spark source mass spectrography are discussed in Section 3. Section 2 summarizes conclusions reached by this study and makes recommendations for further research. The Appendices are as follows: A--SSMS instrument specifications, B--tabulated data from each laboratory, and C--histograms of analytical results by organic content and preparation method.

SECTION 2

CONCLUSIONS AND RECOMMENDATIONS

SSMS analyses were conducted by three laboratories on a set of test samples containing various amounts of organic matter in an effort to evaluate the effects of organics on the SSMS results. These organic test samples and selected NBS SRM materials were used to evaluate several sample preparation methods. The following conclusions are drawn from the organic effects study:

- Organic components of a sample can adversely affect, and in some cases preclude, SSMS data collection.
- Organic molecular spectra can hinder qualitative interpretation of the elemental spectra.
- Molecular spectra produced by organic constituents are readily discernible by SSMS analysts.
- Interference from the coincidence of organic and elemental spectra was not a problem.
- For the test organic matrix used, 50 percent organic content was tolerable.

It is clear from the data obtained that, in some cases, preparation prior to SSMS analysis is necessary. In addition, the delineation of sample preparation methods suitable for Level 2 elemental analyses is highly desired. The following conclusions are drawn from the sample preparation study:

- The Parr Oxygen Bomb (PB) technique eliminates organic constituents adequately for SSMS analysis. Although this procedure can result in a mixed phase sample, it appears to be the most comprehensive SSMS preparation technique when all residues can be collected. While the method is inadequate for the dissolution of many elements, it is an excellent preparation method for cold vapor mercury analysis. In terms of the Level 1 elemental analysis scheme, the only significant drawback to this method is the limited sample size that can be accommodated by the standard apparatus.

- The Low Temperature Plasma Ashing (LTA) technique is superior to any technique studied for the elimination of organic matter. However, when nominally "volatile" elements are of interest, the method is questionable; halogen losses represent a fundamental problem with the method. A major advantage of the method is the ability to accommodate large sample sizes. Disadvantages to the method include: its vulnerability to ambient environmental contamination and the long ashing times required for some samples.

- The Modified Hydrofluoric Acid Digestion Bomb (HFB) technique is the most comprehensive dissolution technique studied. With the addition of a fuming nitric acid step, organic removal can also be accomplished. Concentration steps achieved by solution evaporation will result in the loss of silicon; halogen losses also occur. While the boric acid step aids sample dissolution, the resulting matrix interferes with graphite furnace AAS measurements.

- The Level 1 Acid Extraction (AE) technique is adequate for the preparation of particulate samples for cold vapor mercury analysis. Some other elements can also be successfully extracted by this method; however, the method has limited application potential for Level 2 analysis.

In summary, the Level 1 elemental analysis scheme was found to be reliable and to provide the kind of information desired from the Level 1 study. Problems were noted with some SSMS determinations and additional work in this area is recommended. The preparation of particulate filter samples for SSMS analysis by the AE procedure may bias the resulting data. The HFB method shows great promise as a Level 2 preparation procedure for analytical techniques requiring solution samples. Additional work in this area is needed.

SECTION 3

BACKGROUND

Analysis by spark source mass spectrography (SSMS) permits simultaneous multielement detection and quantitation in a wide variety of samples. This versatility towards the types of samples that can be analyzed, coupled with a panoramic multielement detection and a sensitivity for concentrations well into the parts per billion range, makes SSMS ideally suited for application in the Level 1 elemental analysis of environmental samples.[2]

The SSMS techniques have been used for the trace element analysis of geological samples,[4,5] airborne particulates,[6] aqueous samples,[7] and fossil fuels.[8,9] Analyses of these samples for inorganic materials is necessary to determine their contributions to environmental pollution and their possible classification as potential health hazards.[10] The EPA's Level 1 Environmental Assessment Manual[2] outlines the steps used in the collection of such samples and the subsequent SSMS procedures used in their preparation and analysis. These procedures will be discussed in more detail later.

PRINCIPLES OF SSMS

Most spark source mass spectrometers used in trace element analyses employ a double-focusing technique[11] which combines energy focusing with directional focusing. Also used is the Mattauch-Herzog[3,11,12] ion optical geometry (Figure 1) which acts to focus the ion beam in the 'Z' direction as well as in the focal plane of the instrument. The basic spark source mass spectrometer consists of three distinct sections: the ion source, the electrostatic analyzer, and the magnetic analyzer (Figure 2).[12] Each of these sections is equipped with its own power source and is attached to an evacuation system designed to reduce the internal pressure of the mass spectrometer to approximately 10^{-8} torr. This vacuum is used to limit dispersion of the ion beam caused by collisions with stray gaseous molecules. The mass spectrometers are usually equipped with interlocks in the critical parts of the instrument to protect against vacuum, coolant or power failures.

In the spark source mass spectrometer, ions are generated in the ion source by a high voltage radiofrequency (RF) spark. These ions are accelerated through a large potential while being passed through a series of defining slits which collimate the ion beam before it enters the electrostatic analyzer. The electrostatic analyzer causes an energy selection process to

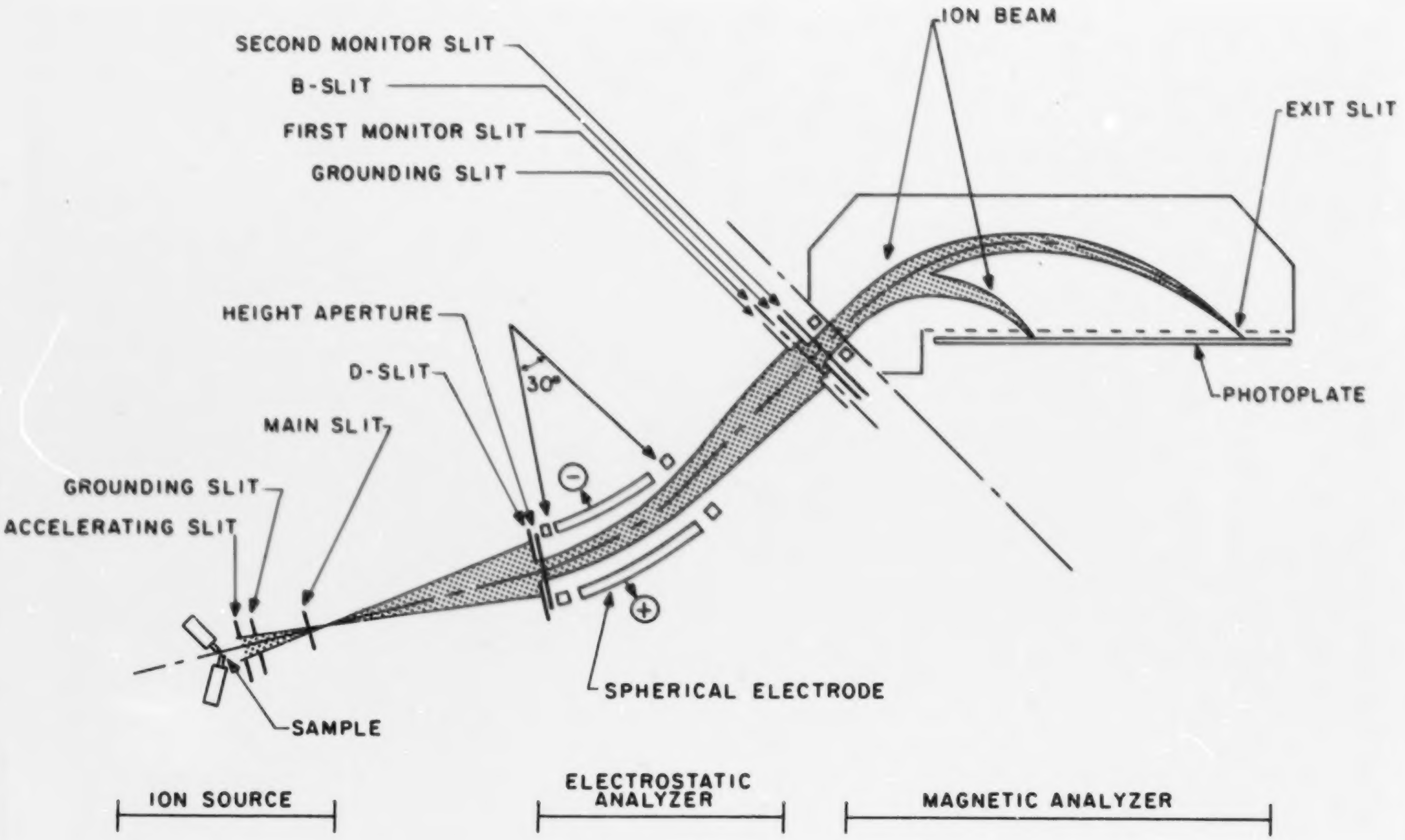
SECOND MONITOR SLIT
B-SLIT
FIRST MONITOR SLIT
GROUNDING SLIT
ION BEAM
EXIT SLIT
HEIGHT APERTURE
D-SLIT
30°
MAIN SLIT
GROUNDING SLIT
ACCELERATING SLIT
PHOTOPLATE
−
+
SAMPLE
SPHERICAL ELECTRODE
ION SOURCE
ELECTROSTATIC ANALYZER
MAGNETIC ANALYZER

Figure 1. Ion optics of a double-focusing spark source mass spectrometer with Mattauch-Herzog geometry.

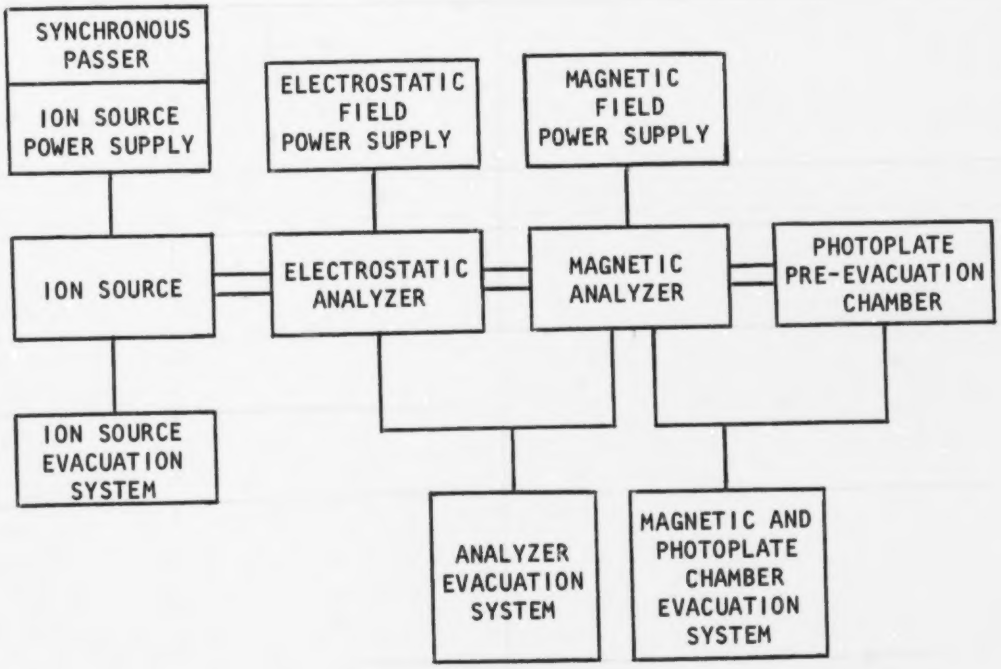
SYNCHRONOUS PASSER
ION SOURCE POWER SUPPLY
ELECTROSTATIC FIELD POWER SUPPLY
MAGNETIC FIELD POWER SUPPLY
ION SOURCE
ELECTROSTATIC ANALYZER
MAGNETIC ANALYZER
PHOTOPLATE PRE-EVACUATION CHAMBER
ION SOURCE EVACUATION SYSTEM
ANALYZER EVACUATION SYSTEM
MAGNETIC AND PHOTOPLATE CHAMBER EVACUATION SYSTEM

Figure 2. Diagram of a spark source mass spectrometer.

to occur in which ions of essentially equal energy are focused by spherical electrodes and then passed into the magnetic analyzer. Upon entering the magnetic analyzer, the ions are subjected to a homogeneous magnetic field which separates the ions by their mass to charge ratio. Since the velocity component of the ions in the ion beam has been defined by the energy selection process of the electrostatic analyzer, the heterogeneous ion beam splits into multiple homogeneous components, each with its own trajectory through the magnetic field (i.e., heavier, slower ions are deflected more than lighter, faster ions of the same charge). Finally, each component is focused onto a detecting medium, in this case, an ion sensitive photoplate.

Spark generation of ions is a necessity to trace element analysis. It is a destructive technique, but fortunately, the sample consumption is relatively small. For measurements in the parts per million level, a miniumum of only a few tenths of a milligram of the sample is consumed. And more importantly, the ions generated in this fashion are basically representative of the elemental composition of the sample.[3]

Spark generation is achieved by using the sample as a pair of electrodes.[13] High frequency, high voltage pulses are then applied to the electrode pair creating an RF spark which ionizes the sample electrodes. The purpose of using a high voltage RF spark is to avoid melting the sample electrodes and to reduce thermal selectivity of the ionization efficiencies for each element.[3]

In preparing the electrodes, there are five major features to be considered:[3] (1) the electrodes must be electrically conducting; (2) the physical strength must be sufficient so that the electrodes can be clamped in the electrode holders; (3) there must be a minimum interference from the mass spectrum of the support material; (4) any materials in the support material must be present at low and known concentrations; and (4) for quantitative analysis, the contribution of the support material (and the sample) to the spark and therefore to the total ion current should be constant and consistent. Spectral grade graphite generally meets all of the above requirements as a support matrix for electrode preparation.

DATA INTERPRETATION AND QUANTITATION

Ion sensitive photoplate detection is chosen for these types of analyses because it allows simultaneous detection of elements from uranium to lithium. Although the dynamic concentration range of the photoplate itself is only 10^3, the actual detection range is greatly increased by using a series of graded exposures.[3] In the analysis, a series of specific quantities of charge are deposited on defined levels of the photoplate, with each exposure differing from the previous one by a factor of 2 or 3. The extent of each exposure is determined by measuring the total ion charge entering the detection region on a coulomb meter. Typically, an exposure range of 10^{-7} to 10^{-12} coulombs is used. These levels are then compared to the exposure level of an internal standard of known concentration to determine the concentration of the element in question.

The data reduction procedure directed by the IERL/RTP procedures manual is known as the "just disappearing line" (JDL) technique.[2,3,11] This technique, as its name implies, utilizes the last discernible exposure level of the element of interest and compares it to a similar exposure level of an internal standard, usually indium. The theory behind the "just disappearing line" technique is based on the characteristic curve as represented in Figure 3. The characteristic curve shows graphically the relationship between the optical density of the mass line and the logarithm of the corresponding exposure. The JDL technique utilizes the most sensitive part of this curve, the "toe" region. The technique works because it always makes its measurement at the same point on the curve (assuming reproducibility of the last level). It suffers, however, from a lack of precision which is determined by the ratio between successive levels of the photoplate.[3]

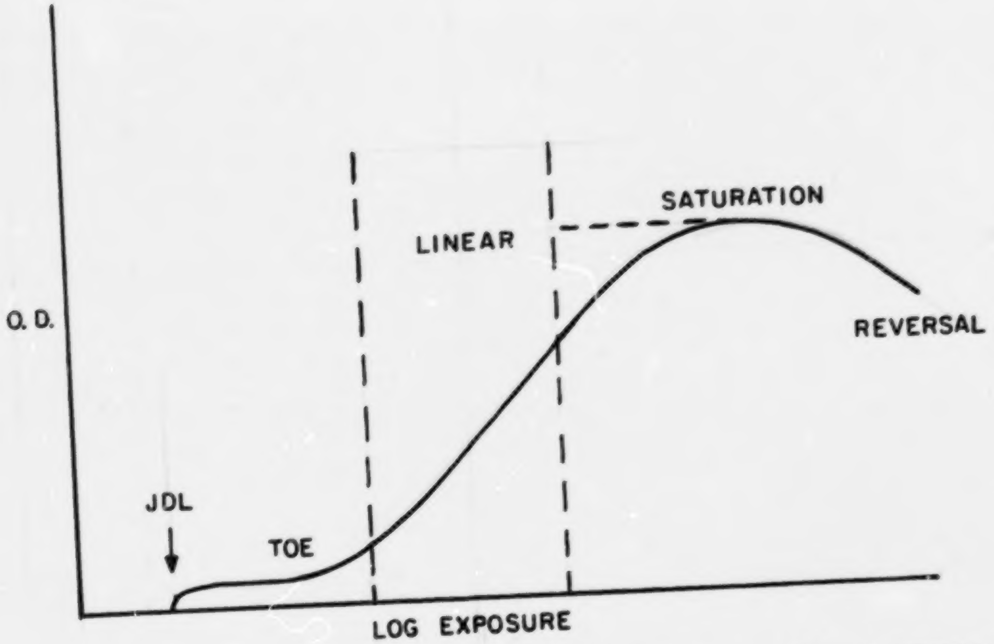

Figure 3. Characteristic curve--optical density vs. log of exposure.

Concentration determination can then be achieved, through the exploitation of the following equation:

$$C_i = \frac{E_s}{E_i} \times \frac{C_s}{100} \times \frac{A_s}{A_i} \times \frac{S_s}{S_i} \times \frac{W_i}{W_s} \times \frac{M_i}{M_s}$$ [11]

where C_i is the concentration of interest,

E_s is the minimum exposure at which the isotope of the internal standard becomes detectable, the JDL,

E_i is the corresponding JDL of the isotope of the element of interest,

C_s is the percent concentration of the known internal standard,

A_s, A_i are the abundances of the isotopes used to determine the JDL (Table 1)

S_s, S_i are the relative sensitivity factors of the ions in question (Table 2),

W_s, W_i are the respective linewidth correction factors (Table 3),

M_s, M_i are the respective atomic masses of the isotopes used in the analysis.

The relative sensitivity factors[14,15] in the previous equation are meant to compensate for phenomena that would result in the ion beam not being truly representative of the sample (e.g., nonuniform ionization efficiency, selective volatilization).[16] The line-width correction factors[17] are incorporated into the equation to adjust for the broadening of the mass spectral lines. This correction adjusts for the fact that a broader line requires more ions to become detectable as compared to a narrower line. Double focusing instruments of Mattauch-Herzog geometry use the ratio of the square roots of the masses for the line width correction.[3]

Results can also be obtained using the "gray-line matching" technique. In this technique, one first identifies one of the matrix ions which is saturated with respect to optical transmittance (i.e., zero transmittance) and records the exposure. Initially this can be done with a densitometer, but the eye can also be trained to do it satisfactorily. One then uses as a reference point this same line recorded at a considerably reduced exposure. An alternative would be to use as a reference line a low abundance isotope of this element, which would be equivalent to a reduced exposure. One then determines visually the exposure at which the optical thickness of the impurity line matches the reference line. The substitute values of E_i and E_s are then used in the last equation. Using this line-matching technique takes advantage of the fact that the visual comparisons are made in the region of Figure 3 where the response of the photoplate is linear when compared with the logarithm of the ion density (coulombs/cm^2). This allows for some interpolation and reduces the impact of judgment errors.

The equation to determine concentration in actual measurements becomes:

$$C_i = \frac{E_s}{E_i} \times \frac{V_s C_s}{\text{Wt. sample}} \times \frac{A_s}{A_i} \times \sqrt{\frac{M_i}{M_s}} \times \frac{M_i}{M_s} \times \frac{S_i}{S_s} \qquad 9$$

where

$\sqrt{\frac{M_i}{M_s}}$ is the line width correction,

TABLE 1. PERCENT ABUNDANCES OF ELEMENTAL ISOTOPES

ELEMENT	ISOTOPE - % ABUNDANCE				
U	238 - 99.3%	–	–	–	–
TH	232 - 100%	–	–	–	–
BI	209 - 100%	–	–	–	–
PB	208 - 52.3%	207 - 22.6%	206 - 23.6%	204 - 1.48%	–
TL	205 - 70.5%	203 - 29.5%	–	–	–
HG	202 - 29.8%	201 - 13.2%	200 - 23.1%	199 - 16.8%	198 - 10%
AU	197 - 100%	–	–	–	–
PT	198 - 7.21%	196 - 25.3%	195 - 33.8%	194 - 32.9%	192 - 0.78%
IR	193 - 62.7%	191 - 37.3%	–	–	–
OS	192 - 41%	190 - 26.4%	169 - 16.1%	188 - 13.3%	187 - 1.64%
RE	187 - 62.5%	165 - 37.5%	–	–	–
W	186 - 28.4%	184 - 30.6%	183 - 14.4%	182 - 26.4%	180 - 0.14%
TA	181 - 100%	180 - 0.012	–	–	–
HF	180 - 35.2%	179 - 13.8%	178 - 27.1%	177 - 18.5%	176 - 5.2%
LU	176 - 2.59%	175 - 97.4%	–	–	–
YB	176 - 12.7%	174 - 31.8%	173 - 16.1%	172 - 21.8%	171 - 14.3%
TM	169 - 100%	–	–	–	–
ER	170 - 14.9%	168 - 27.1%	167 - 22.9%	166 - 33.4%	164 - 1.56%
HO	165 - 100%	–	–	–	–
DY	164 - 28.2%	163 - 25%	162 - 25.5%	161 - 18.9%	160 - 2.29%
TB	159 - 100%	–	–	–	–
GD	160 - 21.9%	158 - 24.9%	157 - 15.7%	156 - 20.5%	155 - 14.7%
EU	153 - 52.2%	151 - 47.8%	–	–	–
SM	154 - 22.7%	152 - 26.7%	149 - 13.8%	148 - 11.2%	147 - 15%
ND	146 - 17.2%	145 - 8.3%	144 - 23.8%	143 - 12.2%	142 - 27.1%
PR	141 - 100%	–	–	–	–
CE	142 - 11.1%	140 - 88.5%	138 - 0.25%	136 - 0.193	–
LA	139 - 99.9%	138 - 0.089	–	–	–
BA	138 - 71.7%	137 - 11.3%	136 - 7.81%	135 - 6.59%	134 - 2.42%
CS	133 - 100%	–	–	–	–
I	127 - 100%	–	–	–	–
TE	125 - 6.99%	130 - 34.5%	128 - 31.8%	126 - 18.7%	124 - 4.61%
SB	123 - 42.8%	121 - 57.2%	–	–	–
SN	120 - 32.8%	119 - 8.58%	118 - 24%	117 - 7.61%	114 - 0.66%
IN	115 - 95.7%	113 - 4.28%	–	–	–
CD	114 - 28.9%	113 - 12.3%	112 - 24.1%	111 - 12.8%	110 - 12.4%
AG	109 - 48.2%	107 - 51.8%	–	–	–
PD	110 - 11.8%	108 - 26.7%	106 - 27.3%	105 - 22.2%	104 - 11%

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TABLE 1 (continued)

```
ELEMENT                        ISOTOPE - % ABUNDANCE
=======      ================================================================
  RH         103 - 100%           -              -              -             -
  RU         104 - 18.6%    102 - 31.6%    101 - 17.1%    100 - 12.6%    99 - 12.7%
  MO         100 - 9.63%    98  - 23.8%    97  - 9.46%    96  - 16.5%    95 - 15.7%
  NB         93  - 100%           -              -              -             -
  ZR         96  - 2.8%     94  - 17.4%    92  - 17.1%    91  - 11.2%    90 - 51.5%
  Y          89  - 100%           -              -              -             -
  SR         88  - 82.6%    87  - 7.02%    86  - 9.86%    84  - 0.56%         -
  RB         87  - 27.8%    85  - 72.2%          -              -             -
  BR         81  - 49.3%    79  - 50.7%          -              -             -
  SE         82  - 9.19%    80  - 49.8%    78  - 23.5%    77  - 7.58%    76 - 9.02%
  AS         75  - 100%           -              -              -             -
  GE         76  - 7.76%    74  - 36.5%    73  - 7.76%    72  - 27.4%    70 - 20.5%
  GA         71  - 39.6%    69  - 60.4%          -              -             -
  ZN         70  - 0.62%    68  - 18.6%    67  - 4.11%    66  - 27.8%    64 - 48.9%
  CU         65  - 30.8%    63  - 69.2%          -              -             -
  Ni         64  - 1.08%    62  - 3.66%    61  - 1.19%    60  - 26.2%    58 - 67.9%
  CO         59  - 100%           -              -              -             -
  FE         58  - 0.33%    57  - 2.19%    56  - 91.7%    54  - 5.82%         -
  MN         55  - 100%           -              -              -             -
  CR         54  - 2.36%    53  - 9.5%     52  - 83.8%    50  - 4.34%         -
  V          51  - 99.8%    50  - 0.24%          -              -             -
  Ti         50  - 5.34%    49  - 5.51%    48  - 73.9%    47  - 7.28%    46 - 7.93%
  SC         45  - 100%           -              -              -             -
  CA         46  - 3E-03    44  - 2.06%    43  - 0.145    42  - 0.64%    40 - 97%
  K          41  - 6.88%    40  - 0.012    39  - 93.1%          -             -
  CL         37  - 24.2%    35  - 75.8%          -              -             -
  S          36  - 0.014    34  - 4.22%    33  - 0.76%    32  - 95%           -
  P          31  - 100%           -              -              -             -
  SI         30  - 3.09%    29  - 4.7%     28  - 92.2%          -             -
  AL         27  - 100%           -              -              -             -
  MG         26  - 11%      25  - 10%      24  - 79%            -             -
  NA         23  - 100%           -              -              -             -
  F          19  - 100%           -              -              -             -
  O          18  - 0.204    17  - 0.037    16  - 99.8%          -             -
  N          15  - 0.37%    14  - 99.6%          -              -             -
  C          13  - 1.11%    12  - 98.9%          -              -             -
  B          11  - 80.4%    10  - 19.6%          -              -             -
  BE         9   - 100%           -              -              -             -
  LI         7   - 92.6%    6   - 7.42%          -              -             -
```

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TABLE 2. RELATIVE SENSITIVITY FACTORS

	MATRIX	
ELEMENT	WATER	FLY ASH
U	0.50	0.59
TH	0.33	0.40
BI	0.91	0.80
PB	0.83	0.67
TL	1.00	0.91
HG	1.00	1.00
AU	0.50	0.50
PT	0.50	0.50
IR	0.50	0.50
OS	0.67	0.67
RE	0.67	0.67
W	1.00	2.00
TA	0.67	0.40
HF	0.67	0.34
LU	1.00	0.48
YB	2.00	1.90
TM	1.00	1.00
ER	1.00	1.00
HO	1.00	2.00
DY	2.00	2.00
TB	2.00	2.80
GD	2.00	2.00
EU	2.00	1.30
SM	1.00	0.83
ND	0.67	1.00
PR	1.00	1.00
CE	0.83	0.83
LA	0.67	0.36
BA	0.67	0.67
CS	3.90	3.90
I	0.22	1.00
TE	0.77	0.80
SB	0.56	0.56
SN	0.67	0.80
IN	1.00	1.00
CD	0.56	3.00
AG	1.00	1.00
PD	0.67	0.50
RH	0.50	0.50
RU	0.42	0.50
MO	0.56	1.00
NB	1.00	0.30
ZR	0.50	0.23
Y	0.59	0.27
SR	0.56	0.56
RB	2.50	2.00
BR	0.13	0.15
SE	0.33	0.33
AS	0.38	0.33
GE	0.56	0.60
GA	0.77	0.80
ZN	0.63	0.43
CU	0.53	0.56
NI	0.63	0.22
CO	0.67	0.33
FE	0.83	0.33
MN	0.71	0.59
CR	0.77	1.00
V	0.63	0.36
TI	0.67	0.36
SC	0.67	0.29
CA	0.63	0.45
K	2.20	2.30
CL	0.10	0.15
S	0.12	0.12
P	0.25	0.25
SI	0.63	0.63
AL	1.00	1.20
MG	0.63	1.00
NA	2.00	2.00
F	0.03	0.05
O	1.00	1.00
N	1.00	1.00
C	1.00	1.00
B	0.20	0.06
BE	0.50	0.30
LI	1.10	1.00

ALL FACTORS RELATIVE TO INDIUM, AW = 115

TABLE 3. LINEWIDTH CORRECTION FACTORS

ELEMENT	ATOMIC WEIGHT	LINEWIDTH FACTOR
U	238. 0	1. 40
TH	232. 0	1. 40
BI	209. 0	1. 40
PB	207. 2	1. 40
TL	204. 4	1. 40
HG	200. 6	1. 40
AU	197. 0	1. 40
PT	195. 1	1. 40
IR	192. 2	1. 40
OS	190. 2	1. 35
RE	186. 2	1. 35
W	183. 9	1. 35
TA	180. 9	1. 35
HF	178. 5	1. 35
LU	175. 0	1. 35
YB	173. 0	1. 30
TM	168. 9	1. 30
ER	167. 3	1. 30
HO	164. 9	1. 30
DY	162. 5	1. 30
TB	158. 9	1. 30
GD	157. 3	1. 20
EU	152. 0	1. 20
SM	150. 4	1. 20
ND	144. 2	1. 10
PR	140. 9	1. 10
CE	140. 1	1. 10
LA	138. 9	1. 10
BA	137. 3	1. 10
CS	132. 9	1. 10
I	126. 9	1. 10
TE	127. 6	1. 10
SB	121. 8	1. 00
SN	118. 7	1. 00
IN	114. 8	1. 00
CD	112. 4	1. 00
AG	107. 9	1. 00
PD	106. 4	1. 00
RH	102. 9	1. 00
RU	101. 1	1. 00
MO	95. 9	1. 00
NB	92. 9	1. 00
ZR	91. 2	1. 00
Y	88. 9	0. 97
SR	87. 6	0. 97
RB	85. 5	0. 96
BR	80. 0	0. 95
SE	79. 0	0. 95
AS	74. 9	0. 94
GE	72. 6	0. 94
GA	69. 7	0. 94
ZN	65. 4	0. 93
CU	63. 5	0. 91
NI	58. 7	0. 90
CO	58. 9	0. 85
FE	55. 8	0. 85
MN	54. 9	0. 85
CR	52. 0	0. 85
V	50. 9	0. 85
TI	47. 9	0. 85
SC	45. 0	0. 90
CA	40. 1	0. 90
K	39. 1	0. 90
CL	35. 5	0. 95
S	32. 0	0. 95
P	31. 0	0. 95
SI	28. 1	1. 00
AL	27. 0	1. 00
MG	24. 3	1. 00
NA	23. 0	1. 00
F	19. 0	1. 00
O	16. 0	1. 00
N	14. 0	1. 00
C	12. 0	1. 00
B	10. 8	1. 10
BE	9. 0	1. 10
LI	6. 9	1. 10

ALL FACTORS RELATIVE TO INDIUM, AW = 115

V_s is the volume of the stock solution used for the internal standard spike, and

C_s is the concentration of the internal standard stock solution.

QUALITATIVE SSMS ANALYSIS

The determination of concentration is only part of the analysis of a photoplate. The analysis also consists of an ability to determine qualitatively if an element is present at all. Although this determination preceeds concentration determination in the analysis procedure, its importance and degree of difficulty are perhaps greater than the quantitative aspect owing to the latter's lack of precision.

The primary problem of quantitative analysis is the recognition of the patterns of mass spectral lines associated with each element.[3] This ability to recognize these explicit patterns only comes with experience. The analyst after "reading" a number of photoplates becomes familiar with the spectra associated with the elements which frequently occur in a specific sample type. Thus, if the spectrum of an element in a sample is familiar to the analyst, it can be a relatively simple matter to determine the elements present. However, if the spectra are unfamiliar to the analyst, it can be a reasonable challenge to identify all the mass lines on a photoplate and associate them with their respective elements. Therefore it is necessary to have unambiguous spectra present at all times. To help the analyst, a reference spectrum of a known standard mixture is obtained and analyzed. Once analyzed, the reference plate is marked at convenient mass intervals, usually 5 to 10 atomic units, and the unknown spectrum is compared to this reference spectrum.

INTERFERENCE BY ORGANIC MATERIAL

It is in the qualitative aspect of trace element analysis by SSMS that the presence of organic material can cause significant problems. Organic material in the samples to be analyzed can adversely affect the ability of the analyst to qualitatively determine an element's presence. Multiple organic ions and ion clusters such as oxides, hydroxides, hydrides and carbides are created by the RF spark. These ions deposit themselves onto the photoplate, thereby, generating an extremely large number of mass spectral lines that are not used in the elemental analysis. Hence, they serve only to increase the difficulty in the qualitative analysis by producing numerous unfamiliar lines. Not only does the presence of organic materials make the process of qualitative analysis tedious, but in some cases impossible. Heavy organic content can produce mass lines of extreme intensity; these lines in some cases mask important elemental lines critical to the analysis of an element.

Molecular spectra are typically produced from organic constitutents in the sample in fairly consistent patterns or "runs." A hydrocarbon run usually takes the form C_nH_{n+x} (X=0, ±1, ±2, ±3, etc.). The spectral lines for X=0 are the most intense, and the intensity rapidly decreases with increasing X.

Another drawback associated with high organic content is an increase in the amount of background fogging. This again is caused by an increase in the amount of ions of a particular mass in the regions associated with organic content.

The nature of these effects and the degree to which the analysis may suffer are dependent on the specific organic material present. A consideration of the vast number of different organic matrices that can be envisioned clearly places constraints on the evaluation study at the outset. It would be an extraordinarily costly, if not futile, effort that endeavors to precisely determine all effects produced by a host of matrices. Therefore, the effects that can be reasonably studied are limited by the choice of test materials. The test samples employed in this study allowed some specific areas to be addressed. The organic matrix chosen contributed only carbon, hydrogen and oxygen to the test samples. This matrix produces an abundance of molecular spectra that are typical of those which might be produced by organic matter in environmental samples.

In analyzing environmental samples for trace elements, there is a need to remove the interfering organic material without biasing the elemental composition of a sample. Thus, the intent of this study was to investigate the effects of organic matter on trace element analysis by SSMS and to evaluate several sample preparation techniques as to their effectiveness in eliminating the organic content of samples without causing elemental losses or contamination.

SECTION 4

EXPERIMENTAL PROCEDURES

The experimental work for this task was conducted in three main stages. First, it was necessary to fabricate test samples that could be used to properly evaluate the effects of residual organic material on SSMS. Next, it was necessary to perform various carbonizing techniques to evaluate their efficiency with respect to the removal of hydrocarbon material. The definition of carbonizing in this report will be expanded to include the removal of volatile hydrocarbons by evaporation along with conversion of hydrocarbons to carbon. Also, a mineral acid extraction (AE) technique was evaluated for samples to be subjected to cold vapor mercury analysis. Finally, it was necessary to submit these samples to three separate laboratories, including our own, for a subsequent Level 1 elemental analysis.

The laboratories used in the elemental analysis were selected to represent a cross-section of instrument types and procedural details. SSMS analyses were performed on SRM 1633-organic mixtures and on NBS SRM 1632 coal samples after preparation by the PB and the LTA techniques. Additional samples were selected and prepared by these techniques and the extracts were then submitted to the participating laboratories for analysis.

All atomic absorption spectrometry (AAS) analyses were performed in-house on a Perkin Elmer Model 460 equipped for both flame and flameless methods. The cold vapor technique described in the Level 1 manual[2] was used for all mercury determinations. Other elemental determinations by AAS employed either standard flame or graphite furnace (Model HGA 2100) techniques, as appropriate.

Selected elemental determinations were also made by inductively coupled argon plasma spectroscopy (ICP). A Jarrell-Ash Model 1160 Plasma AtomComp™, equipped with 24 fixed wavelength channels and a Mark V N+1 channel, was used for all ICP analyses.

FABRICATION OF TEST SAMPLES

The fabricated test samples were prepared from spiked NBS SRM 1633 fly ash and an organic mixture of 80 percent L-ascorbic acid (Fisher Scientific Co.), 10 percent benzoic acid (Fisher Scientific Co.), and 10 percent spectral grade graphite (National Brand-Union Carbide). The NBS fly ash was chosen because it represents a well characterized sample. The organic mixture was chosen because it contributed only oxygen, hydrogen and carbon to the test samples. Also, it formed an abundance of molecular spectral lines on the ion sensitive photoplates which were typical of those that might be caused by residual organic material in environmental samples.

The NBS fly ash, prior to mixing with the organics, was spiked with nine elements (U, Pb, Ce, I, Ag, Se, As, Sc, and Cl) to disguise its identity and to obtain information on the recoverability of these elements. In order to avoid altering the matrix of the test samples, solid compounds obtained from Spex Material Inc. were used as spikes rather than solutions of the elements. The choice of these spikes involved several factors. First, it was necessary to represent a variety of elements which would encompass the elemental range of the SSMS technique. Also, it was desirable that the elements chosen as spikes should have concentrations in the fly ash that would be a ten-fold increase with respect to their original concentrations in the NBS fly ash and still not exceed the working range of the SSMS. The properties of the compounds used as spikes are given in Table 4. Table 5 gives the steps and amounts used in the preparation of the spiked fly ash. Table 6 lists the absolute concentratons of the elements in the spiked NBS fly ash.

The organic mixture used in the test sample preparation consisted of 80 percent L-ascorbic acid, 10 percent benzoic acid and 10 percent graphite. As previously stated, the mixture was chosen because of its contribution to molecular spectra. Ascorbic acid was chosen to be the main component, rather than the benzoic acid, to help retard the burning of the electrodes in the SSMS ion source. The benzoic acid would burn much too rapidly to be useful as the major component of the organic mixture. Spectroscopic grade graphite was added as the third component primarily to disguise the organic mixture and to further inhibit the combustion of the sample during the ionization process in the SSMS. Table 7 shows the breakdown of the preparation of the organic mixture.

The test samples were prepared from the spiked NBS fly ash and the organic mixture. Four representative dilutions of the fly ash were produced. These were 100 percent spiked NBS fly ash/0 percent organic mixture, 90 percent spiked NBS fly ash/10 percent organic mixture, 50 percent spiked NBS fly ash/50 percent organic mixture, and 10 percent spiked NBS fly ash/90 percent organic mixture. These classes of test samples will be referred to throughout the remainder of this report as 0 percent, 10 percent, 50 percent and 90 percent organic matter, respectively. (The NBS fly ash organic contributions were considered to be negligible with respect to the final organic content of the test samples.)

SAMPLE PREPARATION

The majority of the aliquots from the four classes of test samples were analyzed "neat" (i.e., no preparation prior to making into electrodes). The remaining aliquots were subjected to three carbonizing techniques: Parr oxygen bomb (PB), low temperature ashing (LTA) and hydrofluoric acid bomb (HFB).

TABLE 4. MATERIALS FOR NBS FLY ASH (SRM 1633)

Compound	Assay value	Impurities (ppm)	
HIO_3	103% HIO_3	Mg, Ca	0.5-1.0
		Si, Fe, Cu, Ag	0.1-0.5
SeO_2	69.6% Se	Bi, Si	0.5-2.0
		Ca, Cu, Mg, Ag	0.1-1.0
Sc_2O_3	64.1% Sc	Y	4-8
		Yb	1-3
		Al, Ca, Fe, Mg	0.5-1.0
U_3O_8	83.8% U	Fe, Si	10-30
		Ni, Cr	1-5
		Cd, Cu, Mo	0.5-1
PbO	92.4% Pb	Mg, Si, Al, Cu	0.5-1.0
CeO_2	80.3% Ce	Fe, Si, Mg	0.5-2.0
AgCl	-	Al, Mg, Si	0.5-1.0
		Fe, Cu	0.1-0.5
As_2O_3	73.6% As	Fe, Sb	5-10
		Si, Pb, Mg, Cu	0.5-2.0

TABLE 5. PREPARATION OF SPIKED NBS FLY ASH

I. PREPARATION OF ELEMENTAL SPIKE MATERIAL

Spike No. 1	77.8 mg HIO_3
	263.1 mg $Se\ O_2$
	346.0 mg Sc_2O_3
Spike No. 2	232.3 mg Spike No. 1
	105.1 mg U_3O_8
	312.7 mg As_2O_3
	651.4 mg AgCl
	700.0 mg CeO_2
	296.4 mg PbO

II. PREPARATION OF SPIKED FLY ASH[a]

Spiked Fly Ash No. 1	460.1 mg Spike No. 2
	3.5515 g NBS 1633 Fly Ash
Spiked Fly Ash No. 2	800.3 mg Spiked Fly Ash No. 1
	9.2000 g NBS 1633 Fly Ash

The Spiked Fly Ash No. 2 elemental values are given in Table 6 as test samples were prepared from this last spiked fly ash.

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[a] The compounds, once weighed out, were mixed for approximately 1 hour in a clean acid washed polyethylene container. The mixes were then stored in a desiccator.

TABLE 6. THEORETICAL VALUES FOR NBS SRM 1633 FLY ASH INCLUDING SPIKED ELEMENTS

Element	Concentration (ppm)	Element	Concentration (ppm)
U[a]	360	Rb	102
Th	20	Br	9.8
Pb[a]	1160	Se[a]	257
Tl	3.2	As[a]	980
W	3.7	Zn	176
Ta	1.5	Cu	104
Hf	6.4	Ni	80
Lu	0.81	Co	34
Yb	5.7	Fe	5.0 (%)
Tb	1.5	Mn	404
Eu	2.0	Cr	103
Sm	10.0	V	191
Ce[a]	2390	Ti	6030
La	67	Sc[a]	326
Ba	2200	Ca	3.8 (%)
Cs	7.0	K	1.3 (%)
I[a]	79	Cl[a]	685
Sb	5.6	Si	17 (%)
Cd	1.2	Al	10 (%)
Ag[a]	1960	Mg	1.5 (%)
Zr	245	Na	2610
Y	50	Be	9.7
Sr	1380		

[a] Elements which were added (as compounds) to the fly ash.

TABLE 7. PREPARATION OF ORGANIC MIXTURE

L-Ascorbic Acid	8.0000 g
Benzoic Acid	1.0029 g
Graphite	1.0062 g
Total	10.0091 g
% L-Ascorbic Acid	79.93%
% Benzoic Acid	10.02%
% Graphite	10.05%

The mixture was placed in a clean, acid washed polyethylene container, mixed for approximately 1 hour, and stored in a desiccator.

Parr Bomb Combustion

The Parr oxygen bomb required the least amount of time of the three carbonizing techniques (approximately 0.5 hour per sample). The oxygen bomb apparatus was purchased from Parr Instrument Co. and modified in-house. Modifications consisted of replacing the standard electrodes with electrodes fabricated from 97 percent platinum and 3 percent rhodium and fitting the bomb with a fused silica (quartz) liner with cover.

Apparatus and Reagents--

- Parr oxygen bomb with quartz liner and cover, 342 ml capacity (Parr Instrument Co.)
- Oxygen regulator and supply
- Pellet press and die
- Platinum firing wire (0.25 mm dia.)
- Vycor sample cups
- 1:1 HNO_3/H_2O (Baker Ultrex HNO_3)

Procedure--

The procedure used was obtained from the IERL/RTP: Level 1 Procedures Manual[2] and is outlined below. The 0.25 g of benzoic acid specified by the manual was not added since the samples already contained benzoic acid.

(1) Approximately 800 mg aliquots were used for each run.

(2) The aliquot was placed into a clean pellet press die and formed into a solid pellet.

(3) The quartz liner was inserted into the Parr bomb and 10 mls of 1:1 nitric acid were added.

(4) The pellet was placed into a vycor sample cup and the platinum firing wire was attached to the electrodes. To ensure combustion, the platinum wire must be in contact with the sample.

(5) The Parr bomb was assembled and pressurized to 30 atmospheres with oxygen.

(6) The ignition leads were attached and the combustion bomb was placed into a calorimeter and ignited.

(7) After cooling for 15 minutes, the pressure was released and the apparatus was disassembled.

(8) The entire contents of the Parr bomb were washed into a Nalgene volumetric flask (100 ml) and brought up to volume with deionized (DI) water.

Hydrofluoric Acid Bomb

The HFB procedure required approximately 4 hours per sample to complete. In this case, two procedures are suggested, one by Bernas[18] and the other by Hartstein.[19] Both procedures were basically the same and differed only in the amounts of reagents used.

Apparatus and Reagents--

- Hydrofluoric acid bomb (Parr Instrument Co.) with teflon liner and cap
- Aqua regia (3:1 HCl/HNO_3, Baker Ultrex acids)
- Hydrofluoric acid (Baker Ultrex HF)
- An oven at a constant 100°C

Procedure--

The procedure outlined below is by Bernas.[18] The basic differences in reagents and amounts with respect to the Hartstein procedure[19] are noted:

(1) Approximately 0.2 g aliquots were used in each HFB run.

(2) The aliquoted sample was placed into the teflon liner.

(3) Ten 50 μl portions of the aqua regia were added and allowed to flow down the sides of the liner to wash all of the sample to the bottom (Hartstein used approximately 6 mls of fuming nitric acid.)

(4) Three 1 ml portions of HF were added to the liner before capping. (Hartstein also used 3 mls of HF.)

(5) The HFB was assembled and placed into the oven at 100°C.

(6) After about 1 hour, the bomb was disassembled (after cooling) to see if the carbonization process was completed. If it was not, then an extra heating period was used. Two hours at 100°C was usually sufficient to carbonize all materials.

(7) The solution was then filtered through a Whatman No. 41 filter into a Nalgene volumetric flask and diluted to the mark. Boric acid was not added to neutralize the effect of the HF since Nalgene plastic ware was used.

Low Temperature Ashing

The most time-consuming procedure was the LTA, where at least 20 hours were required to ash 1 gram of material. This procedure, although lengthy, required the least amount of sample handling of the three carbonizing procedures. There are no reagents used for LTA.

Apparatus--

The only piece of apparatus used was a Model 302 low temperature asher manufactured by LFE Corporation. This LTA required an oxygen supply and a vacuum pump to remove gaseous by-products.

Procedure--

(1) An amount of sample, which would leave a workable amount of ash, was aliquoted and placed into the quartz sample dish. This amount was dependent on the organic content of the sample.

(2) The sample and dish were weighed together to determine initial weight and then placed into the LTA.

(3) The LTA was activated. The operating parameters were: RF power--250 watts; O_2 flow rate--200 scc/min; and chamber pressure during operation--approximately 1 mm Hg.

(4) The sample was ashed for several hours and then removed, weighed and agitated to expose more surface area. When no further weight loss was observed, ashing was terminated.

(5) The ashed sample was transferred to a polyethylene container and stored in a desiccator until needed.

Acid Extraction

The AE procedure was performed according to the Level 1 acid extraction method for solid samples and particulate filter samples to be subjected to cold vapor mercury analysis.[10] This procedure specifies a 6-hour extraction in a 4 to 1 mixture of HNO_3 and HCl, respectively, followed by filtration and dilution to 100 ml.

ANALYTICAL METHODS

The last stage in the experimental work was the Level 1 elemental analysis. Table 8 gives the number of analyses done by each laboratory on the four classes of samples. The electrode preparation, SSMS operation, and photoplate analysis procedures used by each laboratory are similar in theory. Therefore, the procedures described below are for this laboratory, and any major interlaboratory differences are noted.

Electrode Preparation

(1) A quantity of high purity graphite was aliquoted to give a total weight of sample plus graphite of about 250 mg.

(2) The sample was weighed out (50 mg for solid samples) or pipetted (10 mls for liquid samples) into a teflon evaporating dish.

(3) The graphite aliquot was then added to the sample.

(4) A known amount of an internal standard, usually indium, was added. Other possibilities would be Re or Er, usually in acidic solution.

(5) The sample was made into a slurry with deionized water, if necessary, and stirred with a teflon stirring rod. Other labs also add ethanol as a carbon "wetting" agent.

(6) The volume of the slurry was reduced by about 80 percent under an infrared (IR) heat lamp (120°C).

(7) The sample was reslurried and brought to dryness under the IR irradiation. Other procedures remove the IR lamp just before complete drying and allow the heat of the dish to finish the drying.

(8) The powder was transferred to an agate or teflon vial and mixed for about 1/2 hour in a mixer/mill machine (Spex or equivalent).

(9) The sample, assumed at this point to be homogeneously mixed, was tamped into a three-holed high density polyethylene mold and pressed into electrodes under 10 tons of pressure exerted for 1 minute in a

TABLE 8. SUMMARY OF DATA COLLECTION

Laboratory	% Organic	Number of analyses Neat	PB	LTA	HFB
A	0	2	1	-	-
	10	2	1	-	-
	50	2[a]	1	-	-
	90	2[a]	1	-	-
B	0	1	-	-	-
	10	1	-	-	-
	50	1	-	-	-
	90	-[b]	-	1[b]	-
C	0	3	1	-	-
	10	3	1	-	-
	50	3	1	1	1
	90	-[c]	1	1	-

[a] Lab A needed to dilute one run each of 50% and 90% neat samples by 10 times. They were able to give analyses for the other high percentage samples that were duplicated.

[b] Lab B could not run the 90% organic sample neat, and used LTA instead.

[c] When 90% neat sample was tried by Lab C, the electrodes eroded much too rapidly to obtain an analysis.

hydraulic press. Each of the three electrodes is 2 mm diameter by 15 mm long. One electrode is kept as a reserve.

(10) The electrodes are stored in a desiccator until needed.

SSMS Analysis

SSMS operation for the three labs was the most diverse of the three analytical stages because of the different instruments involved. A description of this laboratory's SSMS operational procedures is given below.

The instrument was a JEOL Analytical Instruments Inc., Model JMS-01BM-2 mass spectrometer. This instrument is a high resolution double-focusing mass spectrometer (Resolution: $M/\Delta M = 10{,}000$) with Mattauch-Herzog ion optics. The specifications of the JEOL JMS-01BM-2 are given in Appendix A. The critical operating parameters used by this laboratory in our experiments are given in Table 9. The operating procedure follows.

TABLE 9. EXPERIMENTAL PARAMETERS FOR SPARK SOURCE MASS SPECTROMETER OPERATION

Electrostatic Field: 2.8

Accelerator Voltage: 28 kV

Magnetic Field Strength: ~10,000 gauss

Pulse Length: 40 μs

Frequency: 300 Hz

Electrode Potential: 7 V

Anode Voltage: 4 kV

Source Pressure: $<1 \times 10^{-7}$ torr

(1) The SSMS is brought to operational condition by successfully evacuating the system to 1×10^{-7} torr.

(2) The ion source is isolated and brought to atmospheric pressure.

(3) The best matching two of the three electrodes are placed into the electrode holders and properly positioned.

(4) The ion source is closed and evacuated to operating pressure.

(5) The photoplate is inserted into the analyzer.

(6) The electrostatic and magnetic analyzers are turned on.

(8) The accelerating potential is activated and the electrode potential is adjusted.

(9) A pre-sparking period of about 5 minutes is used to remove possible surface contamination. At the same time, the rate of charge accumulation is maximized by adjusting the slit width and accelerating potential.

(10) After pre-sparking, successive levels of charge are deposited on the photoplate. (See Table 10.)

(11) After completing the analysis, the SSMS is shut down and the photoplate is removed.

Photoplate Analysis

The photoplate analysis involves development and subsequent data reduction. All labs used the "JDL" and "gray line" matching techniques for data reduction. This laboratory used the following procedure and materials for its photoplate development.

(1) All solutions, photoplates, etc., were allowed to reach ambient temperature.

(2) The photoplate (Ilford Q2) was removed from its cassette and immersed in a developer solution for 5 minutes.

(3) The plate was removed from the developer and quickly placed in a stop bath for 15 seconds, followed by a fixing solution for 2 minutes and 45 seconds.

(4) Finally, it was rinsed in a water bath for about 20 minutes and dried overnight.

Solutions for Developing Photoplates--

Developer Stock A:	25 g potassium bromide 25 g potassium meta-bisulfite 25 g hydroquinone 1000 ml DI water
Developer Stock B:	50 g potassium hydroxide 1000 ml DI water
Working Developer:	200 ml Stock A 200 ml Stock B 400 ml DI water
Stop Bath:	Kodak indicator stop bath
Fixer:	Kodak fixer with hardener

TABLE 10. PHOTOPLATE EXPOSURE SCHEME

Charge (Coulombs)	Level	Relative exposure
Pre-spark	0	NA
1.2×10^{-7}	2	12,000
6×10^{-8}	4	6,000
3×10^{-8}	6	3,000
1.5×10^{-8}	8	1,500
8×10^{-9}	10	800
4×10^{-9}	12	400
2×10^{-9}	14	200
1×10^{-9}	16	100
5×10^{-10}	18	50
2.5×10^{-10}	20	25
1.2×10^{-10}	22	12
6×10^{-11}	24	6
3×10^{-11}	26	3
1.5×10^{-11}	28	1.5
7.5×10^{-12}	30	0.75
4×10^{-12}	32	0.4

SECTION 5

RESULTS AND DISCUSSION

Organic constituents of a sample can potentially affect SSMS elemental determinations in several adverse ways. The general areas in which organics can cause problems include:

(1) Electrode Preparation

(2) Data Collection

(3) Qualitative Interpretation

(4) Quantification

(5) Detection

While each of these subject areas is important to evaluating the effect of organic material on SSMS analysis, only qualitative interpretation and elemental quantitation were studied in depth for this project. These are the two most critical activities in SSMS determinations and were, therefore, given greater emphasis. The remaining potential problems are briefly addressed below:

- Electrode Preparation--These effects were not addressed in this study. However, electrode preparation problems are immediately obvious to the analyst; if suitable electrodes cannot be prepared, then severe matrix problems are indicated.

- Data Collection--Some evaluations of these effects were permitted by the fact that the organic mixture used in the sample fabrication reasonably simulated the sparking (burning) characteristics of incompletely combusted matter. These effects will be briefly discussed later in this section.

- Detection--Here, the only effect expected is that of simple dilution. The presence of significant amounts of organic matter in a sample would alter the ultimate detectability of the elements incorporated in the sample.

EFFECT OF ORGANICS ON NEAT SSMS ANALYSES

Most of the neat samples were analyzed with relatively few problems. The 90 percent organic samples could not, however, be analyzed in a neat form by two of the participating laboratories. The sample electrodes burned too quickly to be analyzed in their instruments. The third laboratory was able to analyze the 90 percent neat sample because of a different instrument design. However, increased pressure in the ion source caused by the combustion of the electrodes increased the difficulty in operating the SSMS because of a slower charge accumulation. Of the six samples containing 90 percent of organic matter, only one set of data on an unaltered 90 percent sample was obtained. All other 90 percent samples required some sample preparation prior to SSMS analysis. This is a prime example of the effects of high organic content on SSMS data collection techniques.

EFFECTIVENESS OF PREPARATION METHODS

In this phase of the study, an evaluation was made of several preparation methods with respect to their effects on SSMS determinations. Primarily, these preparation methods were evaluated in terms of (1) their abilities to eliminate organic constituents in a sample without resulting in elemental losses or contamination, (2) the comprehensiveness of their dissolution capabilities, and (3) their cost-effectiveness with respect to the man-hours involved in the techniques. The preparation methods studied were:

(1) Parr Oxygen Bomb Combustion (PB)

(2) Low Temperature Plasma Ashing (LTA)

(3) Hydrofluoric Acid Digestion Bombing (HFB)

(4) Acid (HNO_3/HCl) Extraction (AE)

Three of the methods, PB, LTA and HFB, effectively eliminated most of the interfering molecular spectra. The photoplates associated with these methods were relatively easy to analyze and contained only a few "extra" spectral lines in the low mass ends of the photoplates. This is a drastic change in the composition of sample spectra when compared to the neat analyzed samples. The neat sample plates exhibited multiple molecular spectra throughout and caused suspected interferences with Hf, Lu, Ho, Dy, Gd, Eu, Br, and Zn determinations. They were tedious to analyze and require greater qualitative data reduction time.

Parr Oxygen Bomb Combustion

The Parr bomb procedure, although the least time consuming of the preparation techniques, suffered from some of the most serious drawbacks. With this procedure, one was limited by the amount of sample that could be comfortably combusted at one time. This fact alone was sufficient to prevent determinations of trace elements near the detection limits of the instrumental techniques employed in Level 1 procedures. Also, incomplete combustion of the sample was a problem. This occurred when there was a high mineral content present in the sample. In such cases, further treatment of the sample after combustion was needed prior to its analysis by techniques such as atomic absorption (AAS) and inductively coupled argon plasma (ICP). These techniques require that samples be in a liquid phase. This further treatment, when necessary, introduces more uncertainties into the analysis by requiring increased sample handling.

Low Temperature Plasma Ashing

The LTA procedure permitted the use of rather large samples which greatly increased the detectability of trace elements over the PB procedure. The major disadvantage of this procedure was the amount of time required to eliminate the organic matrix. Between 6 and 12 hours were required to ash the various test samples and as many as 20 hours were required to ash NBS 1632 coal samples. Table 11 gives ashing times, initial weights, final weights and percent ash for various samples, particularly NBS 1632 coal. As can be seen from this information, ashing 2 grams of NBS coal for 20 hours seems to be as effective in eliminating its organic matter as ashing the same NBS coal for 67.5 hours or 280 hours. Also, Table 11 shows that the use of LTA on some samples may not be advantageous. Samples, such as XAD resin, graphite and pyrolytic graphite, leave extremely small residues that would be difficult to transfer; therefore, subsequent analyses might suffer.

Finally, there was concern over possible elemental losses during the ashing process. Volatile elements, particularly halogens, are reported to be be lost under the vacuum employed by LTA. These losses may be minimized with a better instrument design.

Hydrofluoric Acid Digestion Bombing

The HFB procedure, although more time-consuming than the PB procedure, seemed to yield better results. However, there were several serious drawbacks to this procedure. First, it is potentially dangerous. Great care must be exercised at all times to avoid a serious mishap. In fact, the 50 percent sample was selected for this study because it represents the maximum tolerable organic content according to the manufacturer of the bomb. The manufacturer's warning arises from the explosion potential produced by samples containing primarily (>50 percent) organic constituents. However, it should be noted that this recommendation applies to the standard HF procedure for which the bomb was designed.

There were two procedures for carrying out the digestion, one by Bernas[18] and one by Hartstein[19]. These procedures differed in the relative amounts of acid used. One procedure required about 6 times as much concentrated HF as aqua regia (3 parts concentrated HCl to 1 part HNO_3) whereas the other procedure used fuming HNO_3 instead of aqua regia, in a 2:1 ratio with HF. The choice between the relative amounts of acids used in the digestion procedure present several conflicting criteria.

TABLE 11. SUMMARY OF LOW TEMPERATURE ASHING DATA

Sample	Ashing time (hrs)[a]	Initial weight (g)	Final weight (g)	Percent ash
NBS Coal (SRM 1632a)	20.5	2	0.3	15
	67.5	1.0008	0.2176	22
	67.5	1.0020	0.2312	23
	280	6.0000	1.8610	31
	280	6.0000	1.5287	25
XAD-2 Resin	3.7	0.6	0.0006	0.1
Ground Coal	16.5	2.0000	0.3669	18
Dark Oil	25	4.2742	1.1968	28
Light Oil	25	1.7034	0.0104	0.6
Graphite	8	1.0015	0.0000	-
Pyrolytic Graphite	24.5	0.9002	0.0035	0.4

[a] Total time required to obtain a constant final weight.

HF is good for the decomposition of siliceous materials, but is inhibited by mineral acids. To remove organic matter, HNO_3 is the acid of choice, but its presence may inhibit the action of the HF sufficiently to require much longer heating times. One possible way to circumvent these conflicts is to add the HF to the bomb first, heat sufficiently to decompose any siliceous compounds present, and then, after allowing the bomb to cool, add the aqua regia to decompose the organic matter. This type of procedure, however, is more time-consuming, and because of the added steps needed, more dangerous.

Acid (HNO_3/HCl) Extraction

An acid extraction (AE) procedure using an extraction medium of 4 parts nitric acid to 1 part hydrochloric acid was also evaluated. In the Level 1 scheme,[2] this extraction procedure is employed to prepare all of the primarily inorganic (non-combustible) samples for cold vapor mercury analysis. This method is also used to prepare particulate filter samples for SSMS analysis in situations where the particulate cannot be removed from the filter substrate.

The elemental analysis results obtained on NBS SRM 1633 fly ash prepared by the AE procedure are shown in Table 12. While most of the data in Table 12 are ICP determinations, some AAS data are included as a supplement to ICP results. This is only for elements that were either not detected by ICP or were shown to suffer obvious interferences to the ICP technique. As seen from Table 12, the AE procedure did extract substantial quantities of most elements. With some exceptions, quantities sufficient to meet Level 1 requirements were extraced. However, the data clearly show a negative bias owing to incompleted dissolution. This bias from preparation, combined with the limitations of the Level 1 SSMS procedure, could lead to unacceptable SSMS results. It should be noted that the AE in conjunction with cold vapor AAS yields results for mercury that are adequate for Level 1 and Level 2. However, with a few exceptions, the AE method appears to provide inadequate sample preparation for Level 2 analyses.

SUMMARY OF RESULTS

Appendix B contains all raw data from the three laboratories, and Appendix C contains accuracy analyses on the data in Appendix B in the form of histograms. These histograms show the deviation of the experimentally determined elemental concentrations from the expected concentrations given in Table 6. Not all of the elements analyzed by SSMS are depicted in the histograms, only those whose concentrations were previously known and had verified NBS or spiked values.

The histograms plot elements versus log (X_m/X_a), where X_m is the concentration reported and X_a is the actual concentration. For example, all determinations in the range 0.0 to ± 0.10 are within 25 percent of their true values. The broken vertical lines in Figures 4 and 5 indicate deviations from

TABLE 12. ELEMENTAL RESULTS ON NBS SRM 1633 FLY ASH PREPARED BY THE AE PROCEDURE[a]

	Accepted value (ppm)	Measured value (ppm)	Level 1 requirements	Level 2 requirements[c]
Al (%)	12.7	5.4	✓-	-
Ba	2700	2710	✓	✓
Ca	4.7	2.6[b]	✓	-
Cd	1.45	2.0[b]	✓	o
Co	41.5	27	✓	-
Cr	131	77	✓	-
Cu	128	131	✓	✓
Fe (%)	6.2	3.7	✓	-
Hg	0.14	0.11[b]	✓	✓
K (%)	1.72	0.25[b]	-	-
Mg (%)	1.8	0.92[b]	✓	-
Mn	493	283[b]	✓	-
Ni	98	46	✓	-
Pb	70	22	-	-
Si (%)	21	0.0253	-	-
Ti	7400	2760	✓	-
V	214	214	✓	✓
Zn	210	154	✓	-

[a] Determined by ICP unless noted otherwise.

[b] Determined by AAS.

[c] An accuracy of ±25 percent is assumed for Level 2 requirements.

the actual values by factors of 2 (±0.30) and 3 (±0.48). Since the precision for SSMS is approximately: Xm/Xa = 3 (which translates to ±0.48 on the histograms), all experimentally determined concentrations outside the ±0.48 factor were labeled as inaccurate.

The 0 percent was used as the baseline for all effects considered. Figure 4 shows the results obtained from all laboratories on the 0 percent sample. The results reported by Laboratory B for the 0 percent, 10 percent, and 50 percent samples, which are representative of the results reported by all three laboratories, are shown in Figure 5. As seen from Figure 5, there is little difference in the results for these three samples. Although the data for the 50 percent organic sample indicate a slight positive bias, it does not exceed the expected precision of the measurement. Also, the results from the other laboratories do not substantiate any positive bias with increasing organic content.

Tables 13 through 16 are a summary of all the accuracy analyses. The letter "X" is used to represent concentrations outside the acceptable precision limits. The sign attached to the "X" is used to denote in which direction the concentration is in error, either a plus sign for greater than or a minus sign for less than the accepted values.

As can be seen from Tables 13 through 16, there are many more inaccurate determinations which are lower than the expected values. In fact, only 12 percent of the inaccurate determinations were higher than expected. Therefore, contamination due to the preparation methods appears to be minimal. However, there are a number of elemental losses specific to certain preparation methods. The largest contributor to the elemental loss category was the PB method.

Table 17 shows a comparison of the accuracy analysis data between each of the preparation methods. In this analysis, the neat sample error was used as a basis for comparison because of its relatively low error.

Table 17 shows an increase in the overall error of 412 percent for the PB method as compared to the neat error. If the PB data is excluded from the total number of determinations, then the total error (all the determinations for all the preparation methods) is reduced from 25 percent to 13 percent, thereby decreasing by 50 percent the number of inaccurate determinations.

The reason for this high PB error can be attributed to the fact that imcomplete sample combustion occurs frequently. When the residue left after the PB preparation was retained and combined with the solution prior to SSMS analysis, better results were obtained (Table 18). Therefore, in order to obtain results required by the Level 1 scheme, we recommend that the entire two phase combusted sample (solid and solution) be used in the SSMS analysis.

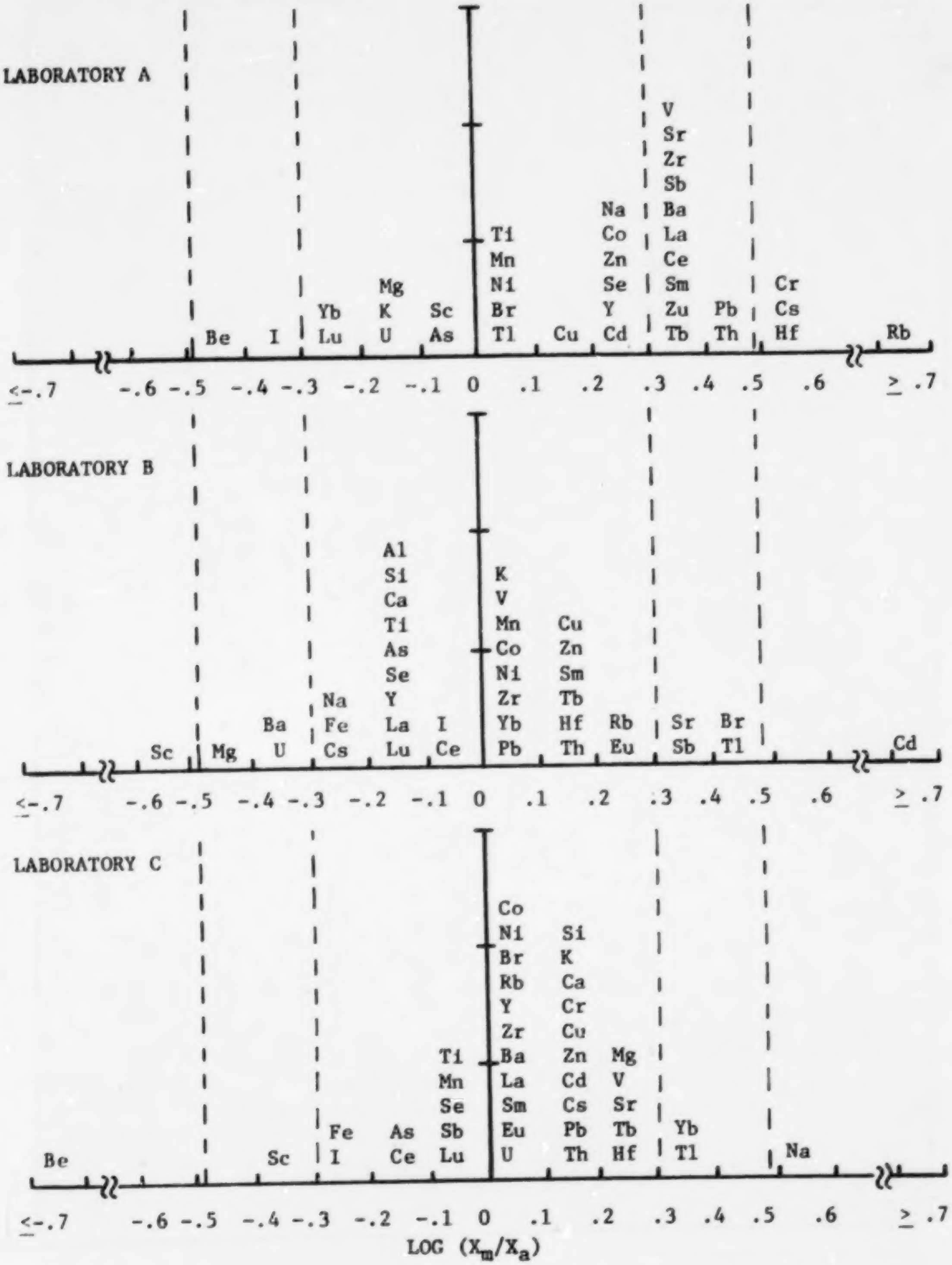

Figure 4. Results for all laboratories on the 0 percent organic sample.

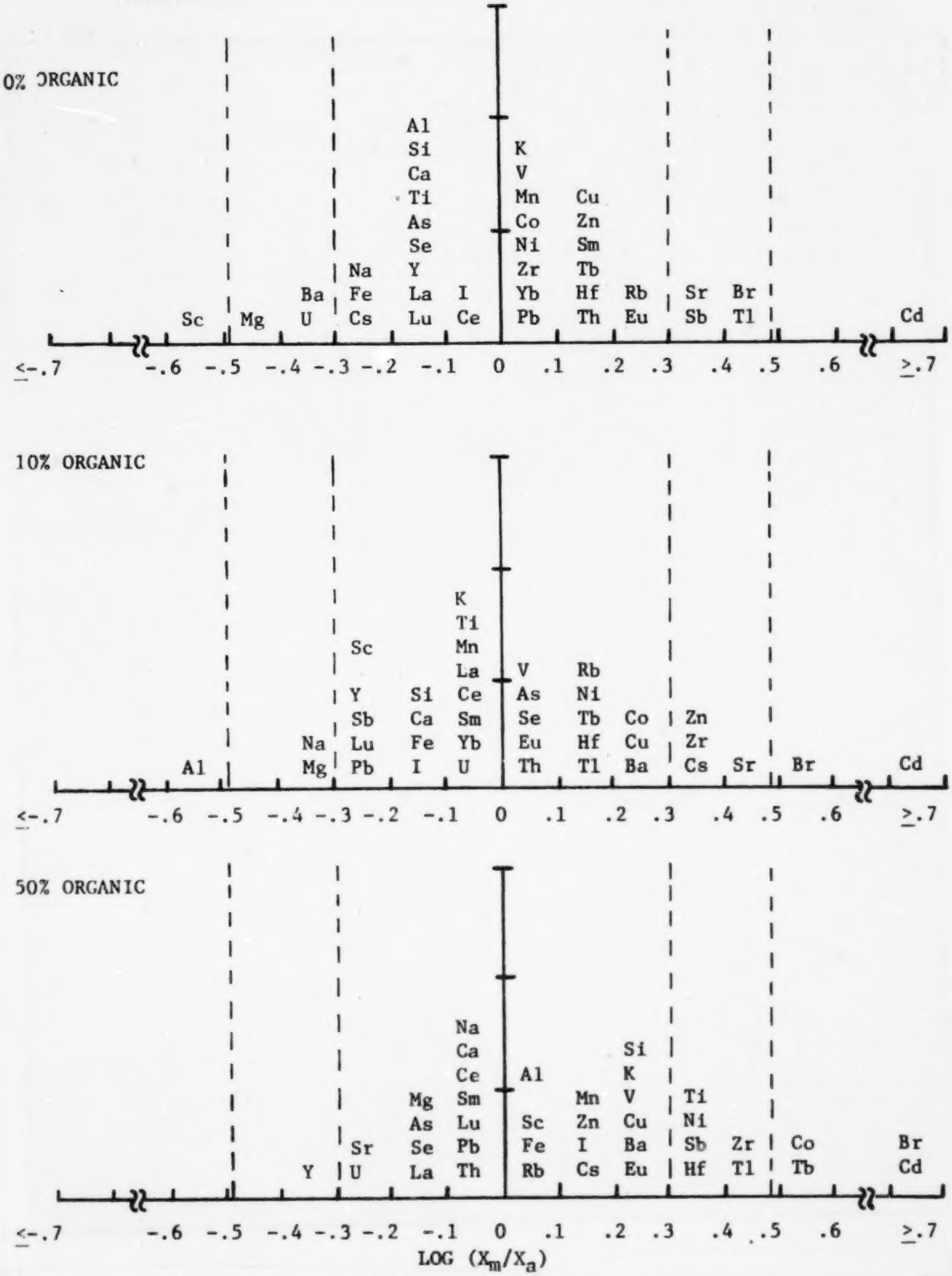

Figure 5. Laboratory B results on the 0 percent, 10 percent, and 50 percent organic samples.

TABLE 13. ACCURACY ANALYSIS ON 0 PERCENT ORGANIC SAMPLES

	Lab A		Lab B	Lab C			
	Average neat	PB	Neat	Average neat	PB	No. +	No. -
U							
Th							
Pb		X-					1
Tl		X-					1
W			X+			1	
Ta	X+	X-	X+	NR[a]	NR	2	1
Hf		X-					1
Lu		X-					1
Yb		X-					1
Tb							
Eu							
Sm		X-					1
Ce					X-		1
La		X-					1
Ba							
Cs		X-			X-		2
I		X-			X-		2
Sb		X-					1
Cd			X+			1	

(continued)

TABLE 13 (continued)

	Lab A		Lab B	Lab C			
	Average neat	PB	Neat	Average neat	PB	No. +	No. -
Ag			X-				1
Zr		X-			X-		2
Y							
Sr							
Rb	X+				X-	1	1
Br		X-			X-		2
Se							
As							
Zn		X-			X-		2
Cu							
Ni		X-			X-		2
Co					X-		1
Fe	X-						1
Mn							
Cr		X-			X-		2
V							
Ti		X-			X-		2
Sc					X-		1
Ca							
K					X-		1

(continued)

TABLE 13 (continued)

	Lab A		Lab B	Lab C			
	Average neat	PB	Neat	Average neat	PB	No. +	No. -
Cl	X-	X-	X-		X-		4
Si	X-	X-			X-		3
Al	X-	X-		NR	X-		3
Mg					X-		1
Na		X-			X-		2
Be			X+	X-	X-	1	2
Totals	6	21	6	1	19	6	47

[a]NR = Not reported.

TABLE 14. ACCURACY ANALYSIS ON 10 PERCENT ORGANIC SAMPLES

	Lab A	Lab B	Lab C			Lab A	Lab C		
	Average neat	Neat	Average neat	No. +	No. -	PB	PB	No. +	No. -
U									
Th							X-		1
Pb			X+	1		X-			1
Tl						X-	X-		2
W		X+		1					
Ta	X+		NR[a]	1		X-	NR		1
Hf							X-		1
Lu							X-		1
Yb									
Tb									
Eu									
Sm									
Ce									
La							X-		1
Ba									
Cs						X-	X-		2
I	X-				1	X-			1
Sb									
Cd		X+		1					
Ag	X-				1	X-	X-		2

(continued)

TABLE 14 (continued)

	Lab A	Lab B	Lab C			Lab A	Lab C		
	Average neat	Neat	Average neat	No. +	No. -	PB	PB	No. +	No. -
Zr							X-		1
Y									
Sr									
Rb	X+			1			X-		1
Br							X-		1
Se									
As									
Zn							X-		1
Cu									
Ni						X-	X-		2
Co							X-		1
Fe	X-				1		X-		1
Mn									
Cr							X-		1
V							X-		1
Ti							X-		1
Sc							X-		1
Ca									
K							X-		1
Cl	X-	X-	X-		3	X-	X-		2

(continued)

TABLE 14 (continued)

	Lab A	Lab B	Lab C			Lab A	Lab C		
	Average neat	Neat	Average neat	No. +	No. -	PB	PB	No. +	No. -
Si	X-		X-		2		X-		1
Al	X-		NR		1		X-		1
Mg			X-		1		X-		1
Na							X-		1
Be		X+	X-	1	1		X-		1
Totals	8	4	5	6	11	8	25		33

[a] NR = Not reported.

TABLE 14 (continued)

	Lab A	Lab B	Lab C			Lab A	Lab C		
	Average neat	Neat	Average neat	No. +	No. -	PB	PB	No. +	No. -
Si	X-		X-		2		X-		1
Al	X-		NR		1		X-		1
Mg			X-		1		X-		1
Na							X-		1
Be		X+	X-	1	1		X-		1
Totals	8	4	5	6	11	8	25		33

[a]NR = Not reported.

TABLE 15. ACCURACY ANALYSIS ON 50 PERCENT ORGANIC SAMPLES

	Lab A	Lab B	Lab C			Lab A	Lab C		
	Average neat	Neat	Average neat	No. +	No. -	PB	PB	No. +	No. -
U									
Th							X-		1
Pb									
Tl									
W		X+		1					
Ta		X+	NR	1		X-	NR		1
Hf						X-			1
Lu						X-			1
Yb									
Tb									
Eu							X-		1
Sm							X-		1
Ce							X-		1
La							X-		1
Ba									
Cs						X-	X-		2
I			X-		1	X-	X-		2
Sb									
Cd		X+		1					
Ag		X-			1	X-			1

(continued)

TABLE 15 (continued)

	Lab A	Lab B	Lab C			Lab A	Lab C		
	Average neat	Neat	Average neat	No. +	No. -	PB	PB	No. +	No. -
Zr						X-	X-		2
Y							X-		1
Sr									
Rb			NR				X-		1
Br		X+	X-	1	1	X-	X-		2
Se									
As							X-		1
Zn						X-	X-		2
Cu							X-		1
Ni						X-			1
Co							X-		1
Fe							X-		1
Mn							X-		1
Ca		X+		1		X-	X-		2
V	X+			1			X-		1
Ti							X-		1
Sc			X-		1		X-		1
Cg							X-		1
K	X-				1	X-	X-		2

(continued)

TABLE 15 (continued)

	Lab A	Lab B	Lab C			Lab A	Lab C		
	Average neat	Neat	Average neat	No. +	No. -	PB	PB	No. +	No. -
Cl	X-	X-	X-		3	X-	X-		2
Si	X-				1	X-	X-		2
Al	X-		NR		1		X-		1
Mg							X-		1
Na						X-	X-		2
Be		X+	X-	1	1		X-		1
Totals	5	8	5	7	11	15	29	0	44

[a]NR = Not reported.

TABLE 16. ACCURACY ANALYSIS ON 90 PERCENT and 50 PERCENT ORGANIC

	Lab A	Lab A	Lab C	Lab B	Lab C	Lab C	Lab C
	90% neat average	90% PB	90% PB	90% LTA	90% LTA	50% LTA	50% HFB
U		X-	X-				
Th		X-	X-				
Pb		X-	X-			X+	
Tl							
W				X+			
Ta			NR[a]	X+	X-	X-	NR
Hf							
Lu						X-	
Yb							
Tb				X+			X+
Eu							
Sm			X-				
Ce		X-	X-	X-			
La		X-	X-				
Ba		X-	X-				
Cs		X-	X-				
I	X-	X-	X-		X-	X-	X-
Sb							
Cd				X+			
Ag	X-	X-	X-	X-	X-		X-

(continued)

TABLE 16 (continued)

	Lab A	Lab A	Lab C	Lab B	Lab C	Lab C	Lab C
	90% neat average	90% PB	90% PB	90% LTA	90% LTA	50% LTA	50% HFB
Zr		X-	X-				
Y			X-				
Sr		X-	X-				
Rb		X-	X-				
Br				X+			
Se		X-				X-	
As							
Zn				X+			
Cu			X-				
Ni		X-					
Co		X-	X-				
Fe		X-	X-				
Mn			X-				
Cr		X-	X-	X+			
V			X-				
Ti		X-	X-				
Sc		X-	X-		X-	X-	
Ca			X-				
K			X-				
Cl		X-	X-	X-	X-		

(continued)

TABLE 16 (continued)

	Lab A	Lab A	Lab C	Lab B	Lab C	Lab C	Lab C
	90% neat average	90% PB	90% PB	90% LTA	90% LTA	50% LTA	50% HFB
Si		X-	X-		X-		X-
Al						NR	NR
Mg			X-		X-		
Na							
Be	—	—	X-	X+	X-	X-	X-
Totals	2	21	28	11	8	7	5

[a]NR = Not reported.

TABLE 17. COMPARISON OF ACCURACY ANALYSIS DATA

	Neat (%)	PB (%)	$\left(\frac{\text{PB\%}}{\text{neat \%}} -1\right) \times 100$
0%	9.8	44.9	358
10%	12.8	37.1	190
50%	13.6	49.4	263
90%	4.4	55.1	1152
Average error	11.3	46.6	412

Calculated LTA error = 19.4%[a]
Calculated HFB error = 11.5%

Percent increase in error compared to neat data[b]

Neat	-
PB	412%
LTA	71%
HFB	3%

---

[a] All percentages calculated by:

$$\frac{\text{No. of pts. outside} + 0.48}{\text{Total no. pts.}}$$

[b] Calculated by:

$$\left(\frac{\text{X\%}}{\text{neat \%}} -1\right) \times 100$$

where X% = PB%, LTA% and HFB% error.

TABLE 18. SSMS RESULTS ON OXYGEN BOMBED 90 PERCENT ORGANIC SAMPLE

Element	Expected value (ppm)	Measured value (ppm)	Effect[a]
U	36.0	34	✓
Th	2.0	3.3	✓
Pb	116	120	✓
Yb	0.57	ND	o
Eu	0.20	0.12	✓
Sm	1.0	0.83	✓
Ce	239	260	✓
La	6.7	13	✓
Ba	220	430	✓
Cs	0.70	0.72	✓
I	7.9	5.0	✓
Sb	0.56	0.84	✓
Cd	0.12	0.14	✓
Zr	24.5	35	✓
Br	0.98	0.52	✓
Se	25.7	38	✓
As	98	140	✓
Zn	17.6	20	✓
Cu	10.4	16	✓
Ni	8.0	16	✓
Co	3.4	6.0	✓
Fe (%)	0.58	0.88	✓
Mn	40.4	53	✓
Cr	10.3	13	✓
V	19.1	24	✓
Ti	603	1000	✓
Ca	3800	4900	✓
K	1300	670	✓
Si (%)	1.7	2.1	✓
Al (%)	1.0	MC	o
Mg	1500	600	✓
Na	261	240	✓

[a] ✓ indicates within a factor of 2; ✓± indicates high (+) or low (-) but within a factor of 3; + or - denote results unacceptably high (+) or low (-), respectively; o means no evaluation made.

Table 17 also shows that the LTA procedure has an increased error of 71 percent over the neat procedure. This is caused mainly by volatile element loss and the inability of the SSMS technique to properly quantitate major compoments in the sample (this was a problem for all the preparation techniques).

Finally, Table 17 shows that the HFB technique had only a 3 percent increase in error over the neat method. Therefore, the HFB method, being negligibly higher in error than the neat method, is the most accurate of the three preparation technique.

Table 19 gives a different perspective of the accuracy analysis. Here, the determinations are grouped by laboratory and subsequently totalled. General problem element determinations for all labs occur with Ta, I, Ag, Cl, Si and Be. These elements are consistently listed outside of the precision range of SSMS. Possible explanations of why these particular elements appear to be problematic are offered below:

- Ta, Ag--tantalum and silver are frequent components of SSMS construction materials. Therefore, it would be relatively easy for ions of these elements to be generated in the ion sources of the SSMS's and contaminants the environment.
- I,Cl--iodine and chlorine are volatile elements. Therefore, losses of these elements could easily occur during any vigorous preparation method.
- Si--silicon is frequently a major component in samples and is also present as an impurity within the graphite used for electrode preparation.
- Be--beryllium is essentially a monoisotopic element with a mass of about 9 AMU. This mass line is frequently confused with a line caused by $^{27}Al^{+3}$, a triply charged ion of aluminum.

Other problem elements that appear to be specific to each lab are: Lab A: Rb, Fe, Al; Lab B: W, Cd, Br, Cr; Lab C: Sc. Most of these problems can be explained by many of the same reasons stated above.

- W--tungsten is close to tantalum lines which appear frequently and could be mistaken for them.
- Cd, Br--cadmium and bromine are volatile elements.
- Fe, Al--iron and aluminum are frequent major components and impurities.
- Rb--rubidium is a frequent impurity.
- Cr--chromium has possible interferences with SiC_2.
- Sc--^{90}Zr or ^{29}SiO can interfere with scandium.

TABLE 19. ELEMENTAL ACCURACY DATA SUMMARY NO. +/NO. - EXCLUDING PB PREP DATA)

	0% organic sample (Table 13)			10% organic sample (Table 14)			50% organic sample (Table 15)			50% and 90% organic sample (Table 16)			Total for all labs		Totals for each lab		
	A	B	C	A	B	C	A	B	C	A	B	C	plus	minus	A	B	C
U																	
Th																	
Pb						1/0						1/0	2	0			2
Tl																	
W		1/0			1/0			1/0			1/0		4	0		4	
Ta	1/0	1/0		1/0				1/0			1/0	0/2	5	2	2	3	2
Hf																	
Lu												0/1	0	1			1
Yb																	
Tb											1/0	1/0	2	0		1	1
Eu																	
Sm																	
Ce											0/1		0	1		1	
La																	
Ba																	
Cs																	
I				0/1					0/1	0/1		0/3	0	6	2		4
Sb																	
Cd		1/0			1/0			1/0			1/0		4	0		4	
Ag		0/1		0/1				0/1		0/1	0/1	0/2	0	7	2	3	2
Zr																	
Y																	

(continued)

TABLE 19 (continued).

	0% organic sample (Table 13)			10% organic sample (Table 14)			50% organic sample (Table 15)			50% and 90% organic sample (Table 16)			Total for all labs		Totals for each lab		
	A	B	C	A	B	C	A	B	C	A	B	C	plus	minus	A	B	C
Sr																	
Rb	1/0			1/0									2	0	2		
Br								1/0	0/1		1/0		2	1		2	1
Se												0/1	0	1			1
As																	
Zn											1/0		1	0		1	
Cu																	
Ni																	
Co																	
Fe	0/1			0/1									0	2	2		
Mn																	
Cr								1/0			1/0		2	0		2	
V							1/0						1	0	1		
Ti																	
Sc									0/1			0/2	0	3			3
Ca																	
K							0/1						0	1	1		
Cl	0/1	0/1		0/1	0/1	0/1	0/1	0/1	0/1		0/1	0/1	0	10	3	4	3
Si	0/1			0/1		0/1	0/1					0/2	0	6	3		3
Al	0/1			0/1			0/1						0	3	3		
Mg						0/1						0/1	0	2			2
Na																	
Be		0/1	0/1		1/0	0/1		1/0	0/1		1/0	0/3	3	7		4	6

To further investigate the preparation techniques, data was compiled from previous and ongoing analyses by atomic absorption spectrometry (AAS) and inductively coupled argon plasma spectrometry (ICP). Table 20 gives AAS values for the PB samples of the four categories of test samples. Again, most of the values obtained by Parr bombing are significantly lower than the expected values. However, the AAS data indicate the utility of the PB method to make accurate determinations for Hg, Cd, As and Se. This is most likely due to the volatility of these elements which would aid in their dissolving completely during the PB combustion process.

Additional data obtained using the HFB method with NBS 1633 fly ash are given in Table 23. The data again show that the HFB results are in good agreement with the expected values and are well within the precision range of the SSMS technique.

A series of analyses were performed using NBS SRM 1632 coal as the sample. SSMS results from these tests are presented in Table 21. Both the LTA and PB data conform fairly well to the Level 1 requirements for the elements listed. In addition, preparation of the NBS coal by the three prep methods and analysis by AAS and ICP were conducted. The data, listed in Table 22, are averages of AAS and ICP values obtained from separate analyses on the same NBS SRM 1632 coal samples. Here, as has been seen before, the PB data are again much lower than expected in most cases. Also, the LTA data are again shown to be slightly inferior to those obtained using the HFB preparation method.

Finally, Table 24 gives a breakdown of different elemental analyses and an overview of their faults, advantages and sensitivities with respect to their environmental assessment (EA) capability.

TABLE 20. SUMMARY OF AAS RESULTS FOR PARR BOMBED SAMPLES

Element	Expected results (ppm)	Normalized results (ppm) for: 0%	10%	50%	90%
Pb	1160	383	346	562	438
Hg	0.11	0.12	0.11	0.20	1.0
Cd	1.2	2.1	2.1	2.2	6.9
Se	257	61	178	80	1200
As	980	1400	1700	780	1200
Zn	176	28	28	30	94
Ca	104	37	39	24	25
Ni	80	19	19	26	38
Mn	404	162	164	85	44
Cr	103	14	15	16	6.3
V	191	107	112	87	313

TABLE 21. SSMS RESULTS ON PREPARED NBS SRM 1632 COAL

		LTA		Oxygen bomb	
Element	Accepted value (ppm)	Measured value (ppm)	Effect[a]	Measured value (ppm)	Effect[a]
U	1.4	1.8	√	0.56	√-
Th	3.0	5.4	√	2.7	√
Pb	30.0	21.0	√	56.0	√
Yb	0.7	ND	o	ND	o
Eu	0.33	ND	o	ND	o
Sm	1.7	ND	o	3.1	√
Ce	19.5	12.0	√	16.0	√
La	10.7	9.6	√	13.0	√
Ba	352.0	270.0	√	430.0	√
Cs	1.4	1.1	√	0.74	√
Sb	3.9	3.0	√	3.4	√
Cd	0.19	0.11	√	0.073	√-
Br	19.3	3.1	-	2.0	-
Se	2.9	3.5	√	2.3	√
As	5.9	13.0	√	8.6	√
Zn	37.0	53.0	√	43.0	√
Cu	18.0	45.0	√+	32.0	√
Ni	15.0	25.0	√	33.0	√
Co	5.7	9.1	√	6.1	√
Fe (%)	0.87	1.3	√	0.90	√
Mn	40.0	40.0	√	53.0	√
Cr	20.2	20.0	√	26.0	√
V	35.0	73.0	√	24.0	√
Ti	1100.0	1500.0	√	1000.0	√
Ca (%)	0.43	0.71	√	0.5	√
K (%)	0.28	0.21	√	0.3	√
Si (%)	3.2	12.0	+	4.4	√
Al (%)	1.85	MC	o	MC	o
Mg (%)	0.2	0.20	√	0.063	-
Na	414.0	1500.0	+	480.0	√

[a] √ indicates within a factor of 2; √± indicates high (+) or low (-) but within a factor of 3; + or - denote results unacceptably high (+) or low (-), respectively; o means no evaluation made.

TABLE 22. ANALYSIS OF NBS SRM 1632a COAL-AVERAGES OF AAS AND ICP VALUES (CONCENTRATION AS μg/g UNLESS OTHERWISE NOTED)

Element	PB	LTA	HFB	NBS[a]
Al (%)	0.052	0.67	1.8	(3.07)
As	6.7	-	-	9.3 ± 0.1
Cd	0.14	0.16	0.99	0.17 ± 0.02
Co	1.4	4.9	7.7	(6.8)
Cr	8.1	13	31	34.4 ± 0.5
Fe	250	7400	9000	11,100 ± 200
Hg	0.08	-	-	0.13 ± 0.03
Mn	1.9	17	15	28 ± 2
Pb	1.8	-	9.9	12.4 ± 0.6
Se	2.4	-	-	2.6 ± 0.7
Si	430	-	-	-
Ti (%)	0.0017	0.015	0.05	(0.175)
V	3.9	20	38	44 ± 3
Zn	7.1	17	28	28 ± 2

[a] Values in parentheses not certified by NBS.

Note: PB preparation is the approved method for Hg, As and Se (ASTM D3684).

TABLE 23. AAS DATA FOR NBS COAL FLY ASH (SRM 1633), USING HFB PREPARATION (CONCENTRATIONS IN μg/g UNLESS OTHERWISE NOTED)

Element	ASTM D-3683 (HF. Ext)	NBS value[a]	Ondov et al.[b]
Al (%)	7.9	-	12.7 ± 0.5
Ba	1860	-	2700 ± 200
Ca (%)	2.6	-	4.7 ± 0.6
Cd	4.25	1.45	-
Co	118	(38)	41.5 ± 1.2
Cr	142	131 ± 2	127 ± 6
Fe (%)	5.67	-	6.2 ± 0.3
K (%)	1.2	(1.72)	1.01 ± 0.15
Mg (%)	0.92	-	1.8 ± 0.4
Mn	487	493 ± 7	496 ± 19
Ni	-	98 ± 3	98 ± 9
Pb	80	70 ± 4	75 ± 5
Si (%)	17.2	-	21 ± 2
V	213	214 ± 8	235 ± 13
Zn	210	210 ± 20	216 ± 25

[a] Values in parentheses not certified.

[b] Ondov, et al., Anal Chem, 47, 1105 (1975).

TABLE 24. ELEMENTAL ANALYSIS METHODS

Method	Analyzable phase	Elements not determined	Problem elements	Determinations per run	EA sensitivity requirements	Matrix problems
SSMS	Solid, Solution	Hg	Br,Cl, F, S,B,Be	72	Adequate	Organics
NAA	Solid, Solution	Bi,Tl,Y,P, B,Be,Li	F,Ca,Cr, Nb,Zr,Se	20	Adequate	Na,Cl
XRF	Solid	Be,B,F,Li	Mg,Na,Al,P S,Cl	60	Inadequate	Adjacent Elements
ICP	Solution	None	Bi,Ge,Rh,Se, Tl,W,Hg,Sb, As	10-60	Adequate	Alkali and Alkaline Earth Metals
AAS	Solution	I,Br,Cl,F, S,C	B,Ir,Ta,U, W,Zr	1-6	Adequate	Certain Anions, Other Metals, High Acid Concentration

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APPENDIX A

JEOL-01BM-2 SSMS SPECIFICATIONS

ION SOURCE/ACCELERATOR POWER SUPPLIES

The specifications of the ion source and the ion accelerating power supplies are as follows:

- RF pulse oscillator:
  - Oscillating frequency: approximately 1 MHz
  - Peak voltage: approximately 100 kV (est.)
  - Peak output: approximately 2 kW (est.)
  - Pulse width: 20, 40, 80 μsec.
  - Pulse repetition frequency: 10, 30, 100, 300, 1,000, 3,000, 10,000 Hz and 1-shot
- Accelerating voltage power supply unit:
  - Accelerating voltage: Variable from 15 to 30 kV
  - Stability: 1 x 10^{-2}/40 min

SYNCHRONOUS PASSER

A Synchronous Passer is placed between the ion source and the electrostatic analyzer and controls the ion beam so that mass spectra with differing exposures (from long to short exposure times) are photographed under constant sparking conditions. The deflection pulse applied to the grate electrodes is synchronized with the spark pulse from the ion source, thus improving the accuracy of quantitative determination. The specifications of the synchronous passer are as follows:

- Pulse width: 60 μsec
- Pulse repetition frequency: 1, 3, 10, 30, 100, 300, 1k, 3k, 10 kHz
- Voltage: DC 400V

ELECTROSTATIC FIELD UNIT

A spherical lens with the following specifications is incorporated to improve the ion current density and sensitivity:

- Rotation angle (ϕe): 30°
- Mean radius (r_e): 20 mm
- Voltage: Variable from 1.5 kV to 3.0 kV
- Stability: 40 ppm/40 min

MAGNETIC FIELD UNIT

The specifications of the magnetic field unit are listed below. To improve the vacuum environment, only the interior of the pole piece is exposed to vacuum:

- Rotation angle (ϕ_m): 90°
- Mean radium (r_m):

  Photoplate detection: Max. 315 mm
  Min. 52 mm

- Field intensity: Max. 13,000 gauss
- Field current stability: 2×10^{-5}/40 min

VACUUM SYSTEM

Newly-developed oil diffusion pumps for ultra-high vacuum are used for the vacuum system.

- Ion getter pump: 140 l/sec
- Oil diffusion pump: 6 in. (oil:DC705)
  4 in. (oil:DC705)
  2.5 in. (oil:DC705)
- Rotary pump: 150 l/min
  80 l/min
- Cold traps: Liquid nitrogen
- Gaskets: Gold and viton

- Bake-out temperature:

  Analyzer: Max. 150°C

  Ion source: Max 300°C or 150°C

- Ultimate vacuum pressure:

  Ion source: 2×10^{-8} Torr.

  Electrostatic field: 8×10^{-9} Torr.

  Magnetic field: 1×10^{-8} Torr.

MONITORS

The following meters are employed as monitors:

- Ammeter:

  Full scale: 3×10^{-11} to 1×10^{-9}

- Coulomb meter (vibrating reed electrometer)

  Full scale: 1×10^{-12} Q to 1×10^{-9}
  With mechanical counter for more than 10^{-9} Q.
  (Max. indication: 9999)

PHOTO PLATE PRE-EVACUATION CHAMBER

- Photo plate used: Ilford Q_2, 380 x 50 x 1 mm

- Accommodates: 8 pieces

- Spectrum light: Approximately 1 mm

APPENDIX B

TABULATED RAW DATA FROM LABORATORIES A, B, AND C

Analytical data on elemental quantification and statistical calculations on these data (i.e., standard deviation, mean, etc.) are presented in the following tables. Because these tables are reproduced directly from computer printouts, it is necessary to provide general information to aid in the interpretation of the data.

- The elements Hg, Re, In, O, N, and C were not quantified in these samples. Therefore, data entries for these elements are "0.000." In standard deviation and RSD calculations of these elements, the entry "999999" appears owing to the nature of the computational program. Time did not permit developing a program which discarded these entries and then retabulating all affected data.

- Error analysis calculated as log (X_m/X_A) resulted in data for many elements being reported as "9999." This is because the calculation was X_m (the measured concentration) divided by X_A (the actual concentration). For many elements there was no known (spiked) or NBS certified value, resulting in a null entry for X_A and division by zero. Table B-51 gives NBS certified values in SRM 1633 fly ash and Table B-52 gives concentrations after spiking.

TABLE B-1. LAB A--0% ORGANIC-NEAT-RUN 1

U	260.	TB	2.8	MO	26.	SC	220.
TH	51.	GD	24.	NB	64.	CA	10000.
BI	3.5	EU	4.6	ZR	550.	K	10000.
PB	2500.	SM	19.	Y	62.	CL	65.
TL	3.4	ND	51.	SR	4000.	S	2400.
HG	0.000	PR	36.	RB	890.	P	3800.
AU	0.10	CE	5000.	BR	12.	SI	10000.
PT	0.10	LA	140.	SE	660.	AL	10000.
IR	0.10	BA	5000.	AS	610.	MG	10000.
OS	0.10	CS	17.	GE	28.	NA	5000.
RE	0.000	I	14.	GA	41.	F	55.
W	4.6	TE	0.39	ZN	320.	O	0.000
TA	12.	SB	12.	CU	120.	N	0.000
HF	20.	SN	4.6	NI	92.	C	0.000
LU	0.58	IN	0.000	CO	38.	B	140.
YB	5.0	CD	1.3	FE	10000.	BE	1.8
TM	1.1	AG	88.	MN	380.	LI	160.
ER	5.0	PD	0.10	CR	490.		
HO	3.5	RH	0.10	V	460.		
DY	9.5	RU	0.10	TI	10000.		

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TABLE B-2. LAB A--0% ORGANIC-NEAT-RUN 2

U	270.	TB	3. 4	MO	26.	SC	340.
TH	51.	GD	60.	NB	64.	CA	10000.
BI	5. 2	EU	4. 6	ZR	550.	K	10000.
PB	3300.	SM	25.	Y	96.	CL	120.
TL	3. 4	ND	51.	SR	2800.	S	1800.
HG	0. 000	PR	36.	RB	890.	P	1800.
AU	0. 10	CE	5000.	BR	10.	SI	10000.
PT	0. 10	LA	140.	SE	220.	AL	10000.
IR	0. 10	BA	5000.	AS	1100.	MG	10000.
OS	0. 10	CS	37.	GE	25.	NA	5000.
RE	0. 000	I	51.	GA	23.	F	38.
W	6. 6	TE	0. 33	ZN	300.	O	0. 000
TA	0. 90	SB	12.	CU	190.	N	0. 000
HF	26.	SN	6. 9	NI	83.	C	0. 000
LU	0. 25	IN	0. 000	CO	70.	B	250.
YB	0. 99	CD	3. 1	FE	10000.	BE	5. 1
TM	1. 3	AG	5000.	MN	410.	LI	64.
ER	10.	PD	0. 10	CR	260.		
HO	3. 1	RH	0. 10	V	460.		
DY	11.	RU	0. 10	TI	5000.		

TABLE B-3. LAB A--0% ORGANIC-NEAT-AVERAGE RUNS 1 AND 2

U	265.	TB	3. 1	MO	26.	SC	280.
TH	51.	GD	42.	NB	64.	CA	10000.
BI	4. 4	EU	4. 6	ZR	550.	K	10000.
PB	2900.	SM	22.	Y	79.	CL	93.
TL	3. 4	ND	51.	SR	3400.	S	2100.
HG	0. 000	PR	36.	RB	890.	P	2800.
AU	0. 10	CE	5000.	BR	11.	SI	10000.
PT	0. 10	LA	140.	SE	440.	AL	10000.
IR	0. 10	BA	5000.	AS	855.	MG	10000.
OS	0. 10	CS	27.	GE	27.	NA	5000.
RE	0. 000	I	33.	GA	32.	F	47.
W	5. 6	TE	0. 36	ZN	310.	O	0. 000
TA	6. 5	SB	12.	CU	155.	N	0. 000
HF	23.	SN	5. 8	NI	88.	C	0. 000
LU	0. 42	IN	0. 000	CO	54.	B	195.
YB	3. 0	CD	2. 2	FE	10000.	BE	3. 5
TM	1. 2	AG	2544.	MN	395.	LI	112.
ER	7. 5	PD	0. 10	CR	375.		
HO	3. 3	RH	0. 10	V	460.		
DY	10.	RU	0. 10	TI	7500.		

TABLE B-4. LAB A--0% ORGANIC-NEAT-STANDARD DEVIATION

U	7. 1	TB	0. 42	MO	0. 000	SC	85.
TH	0. 000	GD	25.	NB	0. 000	CA	0. 000
BI	1. 2	EU	0. 000	ZR	0. 000	K	0. 000
PB	566.	SM	4. 2	Y	24.	CL	39.
TL	0. 000	ND	0. 000	SR	849.	S	424.
HG	0. 000	PR	0. 000	RB	0. 000	P	1414.
AU	0. 000	CE	0. 000	BR	1. 4	SI	0. 000
PT	0. 000	LA	0. 000	SE	311.	AL	0. 000
IR	0. 000	BA	0. 000	AS	346.	MG	0. 000
OS	0. 000	CS	14.	GE	2. 2	NA	0. 000
RE	0. 000	I	26.	GA	13.	F	12.
W	1. 4	TE	0. 042	ZN	14.	O	0. 000
TA	7. 8	SB	0. 000	CU	49.	N	0. 000
HF	4. 2	SN	1. 6	NI	6. 4	C	0. 000
LU	0. 23	IN	0. 000	CO	23.	B	78.
YB	2. 8	CD	1. 3	FE	0. 000	BE	2. 3
TM	0. 14	AG	3473.	MN	21.	LI	68.
ER	3. 5	PD	0. 000	CR	163.		
HO	0. 28	RH	0. 000	V	0. 000		
DY	1. 1	RU	0. 000	TI	3536.		

TABLE B-5. LAB A--0% ORGANIC-NEAT-RELATIVE STANDARD DEVIATION (RSD)

U	0. 027	TB	0. 14	MO	0. 000	SC	0. 30
TH	0. 000	GD	0. 61	NB	0. 000	CA	0. 000
BI	0. 27	EU	0. 000	ZR	0. 000	K	0. 000
PB	0. 20	SM	0. 19	Y	0. 30	CL	0. 42
TL	0. 000	ND	0. 000	SR	0. 25	S	0. 20
HG	999999.	PR	0. 000	RB	0. 000	P	0. 51
AU	0. 000	CE	0. 000	BR	0. 13	SI	0. 000
PT	0. 000	LA	0. 000	SE	0. 71	AL	0. 000
IR	0. 000	BA	0. 000	AS	0. 41	MG	0. 000
OS	0. 000	CS	0. 52	GE	0. 083	NA	0. 000
RE	999999.	I	0. 79	GA	0. 40	F	0. 26
W	0. 25	TE	0. 12	ZN	0. 046	O	999999.
TA	1. 2	SB	0. 000	CU	0. 32	N	999999.
HF	0. 18	SN	0. 28	NI	0. 073	C	999999.
LU	0. 56	IN	999999.	CO	0. 42	B	0. 40
YB	0. 95	CD	0. 58	FE	0. 000	BE	0. 67
TM	0. 12	AG	1. 4	MN	0. 054	LI	0. 61
ER	0. 47	PD	0. 000	CR	0. 43		
HO	0. 086	RH	0. 000	V	0. 000		
DY	0. 11	RU	0. 000	TI	0. 47		

TABLE B-6. LAB A--0% ORGANIC-NEAT-AVERAGE-LOG (X_m/X_A)

U	-0. 120	TB	0. 32	MO	9999.	SC	-0. 060
TH	0. 41	GD	9999.	NB	9999.	CA	-0. 570
BI	9999.	EU	0. 36	ZR	0. 35	K	-0. 100
PB	0. 40	SM	0. 34	Y	0. 20	CL	-0. 860
TL	0. 030	ND	9999.	SR	0. 39	S	9999.
HG	9999.	PR	9999.	RB	0. 94	P	9999.
AU	9999.	CE	0. 32	BR	0. 050	SI	-1. 220
PT	9999.	LA	0. 32	SE	0. 23	AL	-0. 990
IR	9999.	BA	0. 36	AS	-0. 050	MG	-0. 170
OS	9999.	CS	0. 59	GE	9999.	NA	0. 28
RE	9999.	I	-0. 370	GA	9999.	F	9999.
W	0. 18	TE	9999.	ZN	0. 25	O	9999.
TA	0. 64	SB	0. 33	CU	0. 17	N	9999.
HF	0. 56	SN	9999.	NI	0. 040	C	9999.
LU	-0. 280	IN	9999.	CO	0. 20	B	9999.
YB	-0. 270	CD	0. 26	FE	-0. 690	BE	-0. 430
TM	9999.	AG	0. 11	MN	0. 000	LI	9999.
ER	9999.	PD	9999.	CR	0. 56		
HO	9999.	RH	9999.	V	0. 38		
DY	9999.	RU	9999.	TI	0. 090		

TABLE B-7. LAB A--0% ORGANIC-NEAT-STANDARD DEVIATION

U	7. 1	TB	0. 42	MO	0. 000	SC	85.
TH	0. 000	GD	25.	NB	0. 000	CA	0. 000
BI	1. 2	EU	0. 000	ZR	0. 000	K	0. 000
PB	566.	SM	4. 2	Y	24.	CL	39.
TL	0. 000	ND	0. 000	SR	849.	S	424.
HG	999999.	PR	0. 000	RB	0. 000	P	1414.
AU	0. 000	CE	0. 000	BR	1. 4	SI	0. 000
PT	0. 000	LA	0. 000	SE	311.	AL	0. 000
IR	0. 000	BA	0. 000	AS	346.	MG	0. 000
OS	0. 000	CS	14.	GE	2. 2	NA	0. 000
RE	999999.	I	26.	GA	13.	F	12.
W	1. 4	TE	0. 042	ZN	14.	O	999999.
TA	7. 8	SB	0. 000	CU	49.	N	999999.
HF	4. 2	SN	1. 6	NI	6. 4	C	999999.
LU	0. 23	IN	999999.	CO	23.	B	78.
YB	2. 8	CD	1. 3	FE	0. 000	BE	2. 3
TM	0. 14	AG	3473.	MN	21.	LI	68.
ER	3. 5	PD	0. 000	CR	163.		
HO	0. 28	RH	0. 000	V	0. 000		
DY	1. 1	RU	0. 000	TI	3536.		

TABLE B-8. LAB A--0% ORGANIC-NEAT-RSD

U	0.027	TB	0.14	MO	0.000	SC	0.30
TH	0.000	GD	0.61	NB	0.000	CA	0.000
BI	0.27	EU	0.000	ZR	0.000	K	0.000
PB	0.20	SM	0.19	Y	0.30	CL	0.42
TL	0.000	ND	0.000	SR	0.25	S	0.20
HG	999999.	PR	0.000	RB	0.000	P	0.51
AU	0.000	CE	0.000	BR	0.13	SI	0.000
PT	0.000	LA	0.000	SE	0.71	AL	0.000
IR	0.000	BA	0.000	AS	0.41	MG	0.000
OS	0.000	CS	0.52	GE	0.083	NA	0.000
RE	999999.	I	0.79	GA	0.40	F	0.26
W	0.25	TE	0.12	ZN	0.046	O	999999.
TA	1.2	SB	0.000	CU	0.32	N	999999.
HF	0.18	SN	0.28	NI	0.073	C	999999.
LU	0.56	IN	999999.	CO	0.42	B	0.40
YB	0.95	CD	0.58	FE	0.000	BE	0.67
TM	0.12	AG	1.4	MN	0.054	LI	0.61
ER	0.47	PD	0.000	CR	0.43		
HO	0.086	RH	0.000	V	0.000		
DY	0.11	RU	0.000	TI	0.47		

TABLE B-9. LAB A--0% ORGANIC-PARR BOMBED

U	220.	TB	1. 3	MO	11.	SC	110.
TH	10.	GD	3. 2	NB	1. 1	CA	38000.
BI	0. 33	EU	0. 92	ZR	30.	K	6500.
PB	220.	SM	2. 2	Y	19.	CL	30.
TL	0. 17	ND	11.	SR	920.	S	3600.
HG	0. 000	PR	4. 6	RB	28.	P	1000.
AU	0. 080	CE	600.	BR	0. 70	SI	11000.
PT	0. 080	LA	8. 3	SE	210.	AL	24000.
IR	0. 080	BA	1500.	AS	680.	MG	13000.
OS	0. 080	CS	0. 30	GE	5. 7	NA	560.
RE	0. 000	I	1. 1	GA	6. 7	F	320.
W	1. 5	TE	0. 080	ZN	24.	O	0. 000
TA	0. 20	SB	0. 83	CU	69.	N	0. 000
HF	0. 92	SN	0. 70	NI	8. 3	C	0. 000
LU	0. 20	IN	0. 000	CO	68.	B	310.
YB	1. 2	CD	0. 70	FE	19000.	BE	4. 9
TM	0. 080	AG	920.	MN	470.	LI	0. 000
ER	1. 2	PD	0. 080	CR	12.		
HO	0. 50	RH	0. 080	V	77.		
DY	0. 92	RU	0. 080	TI	1400.		

TABLE B-10. LAB A--0% ORGANIC-PARR BOMBED-LOG (X_m/X_A)

U	-0. 200	TB	-0. 050	MO	9999.	SC	-0. 460
TH	-0. 290	GD	9999.	NB	9999.	CA	0. 000
BI	9999.	EU	-0. 330	ZR	-0. 900	K	-0. 290
PB	-0. 710	SM	-0. 650	Y	-0. 410	CL	-1. 350
TL	-1. 260	ND	9999.	SR	-0. 170	S	9999.
HG	9999.	PR	9999.	RB	-0. 550	P	9999.
AU	9999.	CE	-0. 590	BR	-1. 140	SI	-1. 180
PT	9999.	LA	-0. 900	SE	-0. 080	AL	-0. 610
IR	9999.	BA	-0. 160	AS	-0. 150	MG	-0. 050
OS	9999.	CS	-1. 360	GE	9999.	NA	-0. 660
RE	9999.	I	-1. 850	GA	9999.	F	9999.
W	-0. 380	TE	9999.	ZN	-0. 860	O	9999.
TA	-0. 870	SB	-0. 820	CU	-0. 170	N	9999.
HF	-0. 830	SN	9999.	NI	-0. 970	C	9999.
LU	-0. 600	IN	9999.	CO	0. 30	B	9999.
YB	-0. 670	CD	-0. 220	FE	-0. 410	BE	-0. 290
TM	9999.	AG	-0. 320	MN	0. 070	LI	9999.
ER	9999.	PD	9999.	CR	-0. 920		
HO	9999.	RH	9999.	V	-0. 380		
DY	9999.	RU	9999.	TI	-0. 620		

TABLE B-11. LAB A--10% ORGANIC-NEAT-RUN 1

U	120.	TB	1.6	MO	23.	SC	110.
TH	12.	GD	8.0	NB	48.	CA	10000.
BI	1.5	EU	1.3	ZR	300.	K	10000.
PB	540.	SM	12.	Y	59.	CL	65.
TL	0.80	ND	38.	SR	1600.	S	2100.
HG	0.000	PR	27.	RB	360.	P	2400.
AU	0.10	CE	3200.	BR	5.1	SI	10000.
PT	0.27	LA	82.	SE	200.	AL	10000.
IR	0.14	BA	2400.	AS	610.	MG	10000.
OS	0.28	CS	15.	GE	14.	NA	10000.
RE	0.000	I	6.8	GA	40.	F	13.
W	2.6	TE	0.16	ZN	200.	O	0.000
TA	0.60	SB	5.9	CU	110.	N	0.000
HF	9.9	SN	2.0	NI	98.	C	0.000
LU	0.33	IN	0.000	CO	35.	B	250.
YB	2.6	CD	1.4	FE	10000.	BE	2.1
TM	0.59	AG	250.	MN	200.	LI	320.
ER	3.5	PD	0.18	CR	130.		
HO	1.3	RH	0.10	V	460.		
DY	5.4	RU	0.15	TI	5000.		

TABLE B-12. LAB A--10% ORGANIC-NEAT-RUN 2

U	270.	TB	1. 9	MO	46.	SC	270.
TH	90.	GD	30.	NB	64.	CA	10000.
BI	3. 5	EU	3. 1	ZR	550.	K	10000.
PB	3300.	SM	37.	Y	62.	CL	65.
TL	1. 5	ND	180.	SR	1800.	S	2100.
HG	0. 000	PR	130.	RB	410.	P	1800.
AU	0. 10	CE	5000.	BR	5. 1	SI	10000.
PT	0. 10	LA	220.	SE	210.	AL	10000.
IR	0. 10	BA	5000.	AS	610.	MG	10000.
OS	0. 10	CS	17.	GE	14.	NA	5000.
RE	0. 000	I	14.	GA	23.	F	13.
W	5. 8	TE	0. 17	ZN	250.	O	0. 000
TA	18.	SB	12.	CU	120.	N	0. 000
HF	11.	SN	14.	NI	98.	C	0. 000
LU	0. 66	IN	0. 000	CO	52.	B	380.
YB	13.	CD	2. 7	FE	10000.	BE	10.
TM	1. 3	AG	500.	MN	380.	LI	430.
ER	5. 0	PD	0. 10	CR	260.		
HO	1. 7	RH	0. 10	V	460.		
DY	9. 5	RU	0. 10	TI	10000.		

TABLE B-13. LAB A--10% ORGANIC-NEAT-AVERAGE RUNS 1 AND 2

U	195.	TB	1. 8	MO	35.	SC	190.
TH	51.	GD	19.	NB	56.	CA	10000.
BI	2. 5	EU	2. 2	ZR	425.	K	10000.
PB	1920.	SM	25.	Y	61.	CL	65.
TL	1. 2	ND	109.	SR	1700.	S	2100.
HG	0. 000	PR	79.	RB	385.	P	2100.
AU	0. 10	CE	4100.	BR	5. 1	SI	10000.
PT	0. 19	LA	151.	SE	205.	AL	10000.
IR	0. 12	BA	3700.	AS	610.	MG	10000.
OS	0. 19	CS	16.	GE	14.	NA	7500.
RE	0. 000	I	10.	GA	32.	F	13.
W	4. 2	TE	0. 17	ZN	225.	O	0. 000
TA	9. 3	SB	9. 0	CU	115.	N	0. 000
HF	10.	SN	8. 0	NI	98.	C	0. 000
LU	0. 50	IN	0. 000	CO	44.	B	315.
YB	7. 8	CD	2. 1	FE	10000.	BE	6. 1
TM	0. 95	AG	375.	MN	290.	LI	375.
ER	4. 3	PD	0. 14	CR	195.		
HO	1. 5	RH	0. 10	V	460.		
DY	7. 5	RU	0. 13	TI	7500.		

TABLE B-14. LAB A--10% ORGANIC-NEAT-STANDARD DEVIATION

U	106.	TB	0. 22	MO	16.	SC	113.
TH	55.	GD	16.	NB	11.	CA	0. 000
BI	1. 4	EU	1. 3	ZR	177.	K	0. 000
PB	1952.	SM	18.	Y	2. 2	CL	0. 000
TL	0. 50	ND	100.	SR	141.	S	0. 000
HG	999999.	PR	73.	RB	35.	P	424.
AU	0. 000	CE	1273.	BR	0. 000	SI	0. 000
PT	0. 12	LA	98.	SE	7. 1	AL	0. 000
IR	0. 028	BA	1838.	AS	0. 000	MG	0. 000
OS	0. 13	CS	1. 4	GE	0. 000	NA	3536.
RE	999999.	I	5. 1	GA	12.	F	0. 000
W	2. 3	TE	0. 010	ZN	35.	O	999999.
TA	12.	SB	4. 3	CU	7. 1	N	999999.
HF	1. 0	SN	8. 5	NI	0. 000	C	999999.
LU	0. 23	IN	999999.	CO	12.	B	92.
YB	7. 4	CD	0. 92	FE	0. 000	BE	5. 6
TM	0. 50	AG	177.	MN	127.	LI	78.
ER	1. 1	PD	0. 057	CR	92.		
HO	0. 28	RH	0. 000	V	0. 000		
DY	2. 9	RU	0. 036	TI	3536.		

TABLE B-15. LAB A--10% ORGANIC-NEAT-RSD

U	0. 54	TB	0. 12	MO	0. 47	SC	0. 60
TH	1. 1	GD	0. 82	NB	0. 20	CA	0. 000
BI	0. 57	EU	0. 58	ZR	0. 42	K	0. 000
PB	1. 0	SM	0. 71	Y	0. 037	CL	0. 000
TL	0. 42	ND	0. 92	SR	0. 083	S	0. 000
HG	999999.	PR	0. 92	RB	0. 092	P	0. 20
AU	0. 000	CE	0. 31	BR	0. 000	SI	0. 000
PT	0. 63	LA	0. 65	SE	0. 034	AL	0. 000
IR	0. 24	BA	0. 50	AS	0. 000	MG	0. 000
OS	0. 67	CS	0. 088	GE	0. 000	NA	0. 47
RE	999999.	I	0. 51	GA	0. 38	F	0. 000
W	0. 54	TE	0. 059	ZN	0. 16	O	999999.
TA	1. 3	SB	0. 48	CU	0. 061	N	999999.
HF	0. 10	SN	1. 1	NI	0. 000	C	999999.
LU	0. 47	IN	999999.	CO	0. 27	B	0. 29
YB	0. 94	CD	0. 44	FE	0. 000	BE	0. 92
TM	0. 53	AG	0. 47	MN	0. 44	LI	0. 21
ER	0. 25	PD	0. 40	CR	0. 47		
HO	0. 19	RH	0. 000	V	0. 000		
DY	0. 39	RU	0. 28	TI	0. 47		

TABLE B-16. LAB A--10% ORGANIC-NEAT-AVERAGE-LOG (X_m/X_A)

U	-0.210	TB	0.12	MO	9999.	SC	-0.180
TH	0.45	GD	9999.	NB	9999.	CA	-0.530
BI	9999.	EU	0.080	ZR	0.28	K	-0.060
PB	0.26	SM	0.44	Y	0.13	CL	-0.970
TL	-0.370	ND	9999.	SR	0.13	S	9999.
HG	9999.	PR	9999.	RB	0.62	P	9999.
AU	9999.	CE	0.28	BR	-0.230	SI	-1.180
PT	9999.	LA	0.39	SE	-0.050	AL	-0.950
IR	9999.	BA	0.27	AS	-0.150	MG	-0.120
OS	9999.	CS	0.40	GE	9999.	NA	0.50
RE	9999.	I	-0.850	GA	9999.	F	9999.
W	0.10	TE	9999.	ZN	0.15	O	9999.
TA	0.83	SB	0.25	CU	0.090	N	9999.
HF	0.24	SN	9999.	NI	0.13	C	9999.
LU	-0.160	IN	9999.	CO	0.15	B	9999.
YB	0.18	CD	0.28	FE	-0.650	BE	-0.150
TM	9999.	AG	-0.670	MN	-0.090	LI	9999.
ER	9999.	PD	9999.	CR	0.32		
HO	9999.	RH	9999.	V	0.42		
DY	9999.	RU	9999.	TI	0.14		

TABLE B-17. LAB A--10% ORGANIC-NEAT-AVERAGE-NORMALIZED

U	215.	TB	2.0	MO	39.	SC	209.
TH	56.	GD	21.	NB	62.	CA	11000.
BI	2.8	EU	2.4	ZR	468.	K	11000.
PB	2112.	SM	28.	Y	67.	CL	72.
TL	1.3	ND	120.	SR	1870.	S	2310.
HG	0.000	PR	87.	RB	424.	P	2310.
AU	0.11	CE	4510.	BR	5.6	SI	11000.
PT	0.21	LA	166.	SE	226.	AL	11000.
IR	0.13	BA	4070.	AS	671.	MG	11000.
OS	0.21	CS	18.	GE	15.	NA	8250.
RE	0.000	I	11.	GA	35.	F	14.
W	4.6	TE	0.19	ZN	248.	O	0.000
TA	10.	SB	9.9	CU	127.	N	0.000
HF	11.	SN	8.8	NI	108.	C	0.000
LU	0.55	IN	0.000	CO	48.	B	347.
YB	8.6	CD	2.3	FE	11000.	BE	6.7
TM	1.0	AG	413.	MN	319.	LI	413.
ER	4.7	PD	0.15	CR	215.		
HO	1.7	RH	0.11	V	506.		

TABLE B-18. LAB A--10% ORGANIC-PARR BOMBED

U	93.	TB	2.0	MO	32.	SC	490.
TH	14.	GD	11.	NB	14.	CA	68000.
BI	1.1	EU	1.9	ZR	120.	K	8100.
PB	230.	SM	13.	Y	37.	CL	50.
TL	0.20	ND	14.	SR	1300.	S	6000.
HG	0.000	PR	10.	RB	87.	P	4600.
AU	0.060	CE	2200.	BR	3.4	SI	68000.
PT	0.10	LA	50.	SE	290.	AL	180000.
IR	0.060	BA	1900.	AS	2200.	MG	30000.
OS	0.10	CS	1.2	GE	20.	NA	3200.
RE	0.000	I	14.	GA	32.	F	620.
W	3.2	TE	0.40	ZN	120.	O	0.000
TA	0.30	SB	4.2	CU	93.	N	0.000
HF	3.2	SN	2.4	NI	8.1	C	0.000
LU	0.40	IN	0.000	CO	15.	B	680.
YB	3.3	CD	1.6	FE	33000.	BE	7.5
TM	0.30	AG	350.	MN	620.	LI	450.
ER	3.3	PD	0.060	CR	37.		
HO	1.1	RH	0.060	V	300.		
DY	6.2	RU	0.060	TI	4900.		

TABLE B-19. LAB A--10% ORGANIC-PARR BOMBED-LOG (X_m/X_A)

U	-0. 540	TB	0. 17	MO	9999.	SC	0. 22
TH	-0. 100	GD	9999.	NB	9999.	CA	0. 29
BI	9999.	EU	0. 020	ZR	-0. 260	K	-0. 150
PB	-0. 650	SM	0. 16	Y	-0. 080	CL	-1. 090
TL	-1. 150	ND	9999.	SR	0. 020	S	9999.
HG	9999.	PR	9999.	RB	-0. 020	P	9999.
AU	9999.	CE	0. 010	BR	-0. 410	SI	-0. 350
PT	9999.	LA	-0. 080	SE	0. 090	AL	0. 30
IR	9999.	BA	-0. 010	AS	0. 39	MG	0. 34
OS	9999.	CS	-0. 710	GE	9999.	NA	0. 13
RE	9999.	I	-0. 700	GA	9999.	F	9999.
W	-0. 010	TE	9999.	ZN	-0. 110	O	9999.
TA	-0. 650	SB	-0. 070	CU	0. 000	N	9999.
HF	-0. 250	SN	9999.	NI	-0. 940	C	9999.
LU	-0. 260	IN	9999.	CO	-0. 300	B	9999.
YB	-0. 190	CD	0. 17	FE	-0. 130	BE	-0. 060
TM	9999.	AG	-0. 700	MN	0. 23	LI	9999.
ER	9999.	PD	9999.	CR	-0. 390		
HO	9999.	RH	9999.	V	0. 24		
DY	9999.	RU	9999.	TI	-0. 040		

TABLE B-20. LAB A--10% ORGANIC-PARR BOMBED-NORMALIZED

U	102.	TB	2. 2	MO	35.	SC	539.
TH	15.	GD	12.	NB	15.	CA	74800.
BI	1. 2	EU	2. 1	ZR	132.	K	8910.
PB	253.	SM	14.	Y	41.	CL	55.
TL	0. 22	ND	15.	SR	1430.	S	6600.
HG	0. 000	PR	11.	RB	96.	P	5060.
AU	0. 066	CE	2420.	BR	3. 7	SI	74800.
PT	0. 11	LA	55.	SE	319.	AL	198000.
IR	0. 066	BA	2090.	AS	2420.	MG	33000.
OS	0. 11	CS	1. 3	GE	22.	NA	3520.
RE	0. 000	I	15.	GA	35.	F	682.
W	3. 5	TE	0. 44	ZN	132.	O	0. 000
TA	0. 33	SB	4. 6	CU	102.	N	0. 000
HF	3. 5	SN	2. 6	NI	8. 9	C	0. 000
LU	0. 44	IN	0. 000	CO	17.	B	748.
YB	3. 6	CD	1. 8	FE	36300.	BE	8. 3
TM	0. 33	AG	385.	MN	682.	LI	495.
ER	3. 6	PD	0. 066	CR	41.		
HO	1. 2	RH	0. 066	V	330.		
DY	6. 8	RU	0. 066	TI	5390.		

TABLE B-21. LAB A--50% ORGANIC-NEAT-RUN 1

U	100.	TB	1.6	MO	12.	SC	220.
TH	18.	GD	6.9	NB	56.	CA	10000.
BI	1.8	EU	2.7	ZR	180.	K	190.
PB	1000.	SM	12.	Y	35.	CL	36.
TL	0.71	ND	22.	SR	920.	S	1300.
HG	0.000	PR	14.	RB	310.	P	2400.
AU	0.10	CE	1800.	BR	5.1	SI	10000.
PT	0.15	LA	82.	SE	94.	AL	10000.
IR	0.10	BA	1400.	AS	230.	MG	10000.
OS	0.12	CS	17.	GE	14.	NA	5000.
RE	0.000	I	58.	GA	41.	F	250.
W	2.7	TE	0.12	ZN	120.	O	0.000
TA	1.2	SB	6.9	CU	120.	N	0.000
HF	4.6	SN	4.6	NI	55.	C	0.000
LU	0.25	IN	0.000	CO	35.	B	140.
YB	2.3	CD	1.1	FE	10000.	BE	1.2
TM	0.29	AG	500.	MN	440.	LI	92.
ER	3.5	PD	0.10	CR	260.		
HO	1.3	RH	0.10	V	800.		
DY	5.4	RU	0.10	TI	5000.		

TABLE B-22. LAB A--50% ORGANIC-NEAT-RUN 1-LOG (X_m/X_A)

U	-0. 250	TB	0. 33	MO	9999.	SC	0. 13
TH	0. 26	GD	9999.	NB	9999.	CA	-0. 270
BI	9999.	EU	0. 43	ZR	0. 17	K	-1. 520
PB	0. 24	SM	0. 38	Y	0. 15	CL	-0. 970
TL	-0. 340	ND	9999.	SR	0. 12	S	9999.
HG	9999.	PR	9999.	RB	0. 78	P	9999.
AU	9999.	CE	0. 16	BR	0. 020	SI	-0. 920
PT	9999.	LA	0. 39	SE	-0. 130	AL	-0. 690
IR	9999.	BA	0. 10	AS	-0. 320	MG	0. 12
OS	9999.	CS	0. 69	GE	9999.	NA	0. 58
RE	9999.	I	0. 17	GA	9999.	F	9999.
W	0. 16	TE	9999.	ZN	0. 13	O	9999.
TA	0. 20	SB	0. 39	CU	0. 36	N	9999.
HF	0. 16	SN	9999.	NI	0. 14	C	9999.
LU	-0. 200	IN	9999.	CO	0. 31	B	9999.
YB	-0. 080	CD	0. 26	FE	-0. 390	BE	-0. 600
TM	9999.	AG	-0. 280	MN	0. 34	LI	9999.
ER	9999.	PD	9999.	CR	0. 70		
HO	9999.	RH	9999.	V	0. 92		
DY	9999.	RU	9999.	TI	0. 22		

TABLE B-23. LAB A--50% ORGANIC-NEAT-RUN 1-NORMALIZED

U	200.	TB	3. 2	MO	24.	SC	440.
TH	36.	GD	14.	NB	112.	CA	20000.
BI	3. 6	EU	5. 4	ZR	360.	K	380.
PB	2000.	SM	24.	Y	70.	CL	72.
TL	1. 4	ND	44.	SR	1840.	S	2600.
HG	0. 000	PR	28.	RB	620.	P	4800.
AU	0. 20	CE	3600.	BR	10.	SI	20000.
PT	0. 30	LA	164.	SE	188.	AL	20000.
IR	0. 20	BA	2800.	AS	460.	MG	20000.
OS	0. 24	CS	34.	GE	28.	NA	10000.
RE	0. 000	I	116.	GA	82.	F	500.
W	5. 4	TE	0. 24	ZN	240.	O	0. 000
TA	2. 4	SB	14.	CU	240.	N	0. 000
HF	9. 2	SN	9. 2	NI	110.	C	0. 000
LU	0. 50	IN	0. 000	CO	70.	B	280.
YB	4. 6	CD	2. 2	FE	20000.	BE	2. 4
TM	0. 58	AG	1000.	MN	880.	LI	184.
ER	7. 0	PD	0. 20	CR	520.		
HO	2. 6	RH	0. 20	V	1600.		
DY	11.	RU	0. 20	TI	10000.		

TABLE B-24. LAB A--50% ORGANIC-NEAT-RUN 2

U	12.	TB	0. 72	MO	3. 9	SC	58.
TH	6. 7	GD	4. 0	NB	8. 0	CA	10000.
BI	1. 4	EU	2. 6	ZR	56.	K	1600.
PB	600.	SM	5. 0	Y	24.	CL	42.
TL	1. 6	ND	8. 2	SR	600.	S	2400.
HG	0. 000	PR	8. 1	RB	39.	P	1600.
AU	0. 22	CE	580.	BR	4. 8	SI	10000.
PT	0. 65	LA	5. 7	SE	44.	AL	10000.
IR	0. 35	BA	660.	AS	610.	MG	10000.
OS	0. 53	CS	1. 9	GE	4. 7	NA	4600.
RE	0. 000	I	2. 9	GA	6. 1	F	680.
W	0. 95	TE	0. 10	ZN	90.	O	0. 000
TA	2. 5	SB	1. 4	CU	100.	N	0. 000
HF	6. 6	SN	0. 92	NI	11.	C	0. 000
LU	0. 27	IN	0. 000	CO	37.	B	330.
YB	20.	CD	0. 62	FE	10000.	BE	1. 7
TM	0. 72	AG	64.	MN	490.	LI	240.
ER	3. 6	PD	0. 44	CR	2. 0		
HO	1. 3	RH	0. 12	V	170.		
DY	2. 2	RU	0. 37	TI	2000.		

TABLE B-25. LAB A--50% ORGANIC-NEAT-RUN 2-LOG (X_m/X_A)

U	-1. 170	TB	-0. 010	MO	9999.	SC	-0. 440
TH	-0. 160	GD	9999.	NB	9999.	CA	-0. 270
BI	9999.	EU	0. 41	ZR	-0. 330	K	-0. 600
PB	0. 010	SM	0. 000	Y	-0. 010	CL	-0. 900
TL	0. 000	ND	9999.	SR	-0. 050	S	9999.
HG	9999.	PR	9999.	RB	-0. 110	P	9999.
AU	9999.	CE	-0. 300	BR	0. 000	SI	-0. 920
PT	9999.	LA	-0. 760	SE	-0. 460	AL	-0. 690
IR	9999.	BA	-0. 210	AS	0. 10	MG	0. 12
OS	9999.	CS	-0. 260	GE	9999.	NA	0. 55
RE	9999.	I	-1. 120	GA	9999.	F	9999.
W	-0. 280	TE	9999.	ZN	0. 010	O	9999.
TA	0. 52	SB	-0. 290	CU	0. 28	N	9999.
HF	0. 31	SN	9999.	NI	-0. 550	C	9999.
LU	-0. 170	IN	9999.	CO	0. 34	B	9999.
YB	0. 85	CD	0. 010	FE	-0. 390	BE	-0. 450
TM	9999.	AG	-1. 180	MN	0. 38	LI	9999.
ER	9999.	PD	9999.	CR	-1. 400		
HO	9999.	RH	9999.	V	0. 25		
DY	9999.	RU	9999.	TI	-0. 170		

TABLE B-26. LAB A--50% ORGANIC-NEAT-RUN 2-NORMALIZED

U	24.	TB	1. 4	MO	7. 8	SC	116.
TH	13.	GD	8. 0	NB	16.	CA	20000.
BI	2. 8	EU	5. 2	ZR	112.	K	3200.
PB	1200.	SM	10.	Y	48.	CL	84.
TL	3. 2	ND	16.	SR	1200.	S	4800.
HG	0. 000	PR	16.	RB	78.	P	3200.
AU	0. 44	CE	1160.	BR	9. 6	SI	20000.
PT	1. 3	LA	11.	SE	88.	AL	20000.
IR	0. 70	BA	1320.	AS	1220.	MG	20000.
OS	1. 1	CS	3. 8	GE	9. 4	NA	9200.
RE	0. 000	I	5. 8	GA	12.	F	1360.
W	1. 9	TE	0. 20	ZN	180.	O	0. 000
TA	5. 0	SB	2. 8	CU	200.	N	0. 000
HF	13.	SN	1. 8	NI	22.	C	0. 000
LU	0. 54	IN	0. 000	CO	74.	B	660.
YB	40.	CD	1. 2	FE	20000.	BE	3. 4
TM	1. 4	AG	128.	MN	980.	LI	480.
ER	7. 2	PD	0. 88	CR	4. 0		
HO	2. 6	RH	0. 24	V	340.		
DY	4. 4	RU	0. 74	TI	4000.		

TABLE B-27. LAB A--50% ORGANIC-NEAT-AVERAGE RUNS 1 AND 2

U	56.	TB	1.2	MO	8.0	SC	139.
TH	12.	GD	5.5	NB	32.	CA	10000.
BI	1.6	EU	2.7	ZR	118.	K	895.
PB	800.	SM	8.5	Y	30.	CL	39.
TL	1.2	ND	15.	SR	760.	S	1850.
HG	0.000	PR	11.	RB	175.	P	2000.
AU	0.16	CE	1190.	BR	5.0	SI	10000.
PT	0.40	LA	44.	SE	69.	AL	10000.
IR	0.23	BA	1030.	AS	420.	MG	10000.
OS	0.33	CS	9.5	GE	9.4	NA	4800.
RE	0.000	I	30.	GA	24.	F	465.
W	1.8	TE	0.11	ZN	105.	O	0.000
TA	1.9	SB	4.2	CU	110.	N	0.000
HF	5.6	SN	2.8	NI	33.	C	0.000
LU	0.26	IN	0.000	CO	36.	B	235.
YB	11.	CD	0.86	FE	10000.	BE	1.5
TM	0.51	AG	282.	MN	465.	LI	166.
ER	3.6	PD	0.27	CR	131.		
HO	1.3	RH	0.11	V	485.		
DY	3.8	RU	0.24	TI	3500.		

TABLE B-28. LAB A--50% ORGANIC-AVERAGE-LOG (X_m/X_A)

U	-0. 500	TB	0. 20	MO	9999.	SC	-0. 060
TH	0. 080	GD	9999.	NB	9999.	CA	-0. 270
BI	9999.	EU	0. 43	ZR	-0. 010	K	-0. 850
PB	0. 14	SM	0. 23	Y	0. 080	CL	-0. 940
TL	-0. 110	ND	9999.	SR	0. 040	S	9999.
HG	9999.	PR	9999.	RB	0. 54	P	9999.
AU	9999.	CE	0. 000	BR	0. 010	SI	-0. 920
PT	9999.	LA	0. 12	SE	-0. 260	AL	-0. 690
IR	9999.	BA	-0. 020	AS	-0. 060	MG	0. 12
OS	9999.	CS	0. 43	GE	9999.	NA	0. 57
RE	9999.	I	-0. 110	GA	9999.	F	9999.
W	0. 000	TE	9999.	ZN	0. 080	O	9999.
TA	0. 40	SB	0. 18	CU	0. 33	N	9999.
HF	0. 24	SN	9999.	NI	-0. 070	C	9999.
LU	-0. 180	IN	9999.	CO	0. 33	B	9999.
YB	0. 59	CD	0. 16	FE	-0. 390	BE	-0. 500
TM	9999.	AG	-0. 530	MN	0. 36	LI	9999.
ER	9999.	PD	9999.	CR	0. 41		
HO	9999.	RH	9999.	V	0. 71		
DY	9999.	RU	9999.	TI	0. 060		

TABLE B-29. LAB A--50% ORGANIC-AVERAGE NORMALIZED

U	112.	TB	2. 4	MO	16.	SC	278.
TH	24.	GD	11.	NB	64.	CA	20000.
BI	3. 2	EU	5. 4	ZR	236.	K	1790.
PB	1600.	SM	17.	Y	60.	CL	78.
TL	2. 4	ND	30.	SR	1520.	S	3700.
HG	0. 000	PR	22.	RB	350.	P	4000.
AU	0. 32	CE	2380.	BR	10.	SI	20000.
PT	0. 80	LA	88.	SE	138.	AL	20000.
IR	0. 46	BA	2060.	AS	840.	MG	20000.
OS	0. 66	CS	19.	GE	19.	NA	9600.
RE	0. 000	I	60.	GA	48.	F	930.
W	3. 6	TE	0. 22	ZN	210.	O	0. 000
TA	3. 8	SB	8. 4	CU	220.	N	0. 000
HF	11.	SN	5. 6	NI	66.	C	0. 000
LU	0. 52	IN	0. 000	CO	72.	B	470.
YB	22.	CD	1. 7	FE	20000.	BE	3. 0
TM	1. 0	AG	564.	MN	930.	LI	332.
ER	7. 2	PD	0. 54	CR	262.		
HO	2. 6	RH	0. 22	V	970.		
DY	7. 6	RU	0. 48	TI	7000.		

TABLE B-30. LAB A--50% ORGANIC-STANDARD DEVIATION

U	62.	TB	0. 62	MO	5. 7	SC	115.
TH	8. 0	GD	2. 1	NB	34.	CA	0. 000
BI	0. 28	EU	0. 10	ZR	88.	K	997.
PB	283.	SM	4. 9	Y	7. 8	CL	4. 2
TL	0. 63	ND	9. 8	SR	226.	S	778.
HG	999999.	PR	4. 2	RB	192.	P	566.
AU	0. 085	CE	863.	BR	0. 22	SI	0. 000
PT	0. 35	LA	54.	SE	35.	AL	0. 000
IR	0. 18	BA	523.	AS	269.	MG	0. 000
OS	0. 29	CS	11.	GE	6. 6	NA	283.
RE	999999.	I	39.	GA	25.	F	304.
W	1. 2	TE	0. 014	ZN	21.	O	999999.
TA	0. 92	SB	3. 9	CU	14.	N	999999.
HF	1. 4	SN	2. 6	NI	31.	C	999999.
LU	0. 014	IN	999999.	CO	1. 4	B	134.
YB	13.	CD	0. 34	FE	0. 000	BE	0. 36
TM	0. 30	AG	308.	MN	35.	LI	105.
ER	0. 10	PD	0. 24	CR	182.		
HO	0. 000	RH	0. 014	V	445.		
DY	2. 3	RU	0. 19	TI	2121.		
ER	0. 028	PD	0. 89	CR	1. 4		
HO	0. 000	RH	0. 13	V	0. 92		
DY	0. 60	RU	0. 80	TI	0. 61		

TABLE B-31. LAB A--50% ORGANIC-RSD

U	1. 1	TB	0. 52	MO	0. 72	SC	0. 82
TH	0. 67	GD	0. 37	NB	1. 1	CA	0. 000
BI	0. 18	EU	0. 037	ZR	0. 74	K	1. 1
PB	0. 35	SM	0. 58	Y	0. 26	CL	0. 11
TL	0. 53	ND	0. 65	SR	0. 30	S	0. 42
HG	999999.	PR	0. 38	RB	1. 1	P	0. 28
AU	0. 53	CE	0. 72	BR	0. 045	SI	0. 000
PT	0. 88	LA	1. 2	SE	0. 51	AL	0. 000
IR	0. 77	BA	0. 51	AS	0. 64	MG	0. 000
OS	0. 88	CS	1. 1	GE	0. 70	NA	0. 059
RE	999999.	I	1. 3	GA	1. 0	F	0. 65
W	0. 69	TE	0. 13	ZN	0. 20	O	999999.
TA	0. 49	SB	0. 93	CU	0. 13	N	999999.
HF	0. 25	SN	0. 93	NI	0. 94	C	999999.
LU	0. 054	IN	999999.	CO	0. 039	B	0. 57
YB	1. 1	CD	0. 39	FE	0. 000	BE	0. 24
TM	0. 60	AG	1. 1	MN	0. 076	LI	0. 63

TABLE B-32. LAB A--50% ORGANIC-PARR BOMBED

U	110.	TB	0.81	MO	4.8	SC	50.
TH	3.0	GD	2.0	NB	0.62	CA	12000.
BI	3.2	EU	0.60	ZR	16.	K	1400.
PB	410.	SM	1.6	Y	14.	CL	18.
TL	1.6	ND	9.4	SR	340.	S	3200.
HG	0.000	PR	4.7	RB	17.	P	170.
AU	0.060	CE	540.	BR	1.2	SI	4100.
PT	0.060	LA	14.	SE	120.	AL	15000.
IR	0.060	BA	690.	AS	410.	MG	2400.
OS	0.060	CS	0.40	GE	2.6	NA	240.
RE	0.000	I	0.62	GA	5.4	F	56.
W	0.94	TE	0.10	ZN	17.	O	0.000
TA	0.060	SB	1.7	CU	17.	N	0.000
HF	0.40	SN	1.0	NI	2.4	C	0.000
LU	0.060	IN	0.000	CO	4.8	B	62.
YB	0.94	CD	0.40	FE	11000.	BE	6.9
TM	0.060	AG	120.	MN	120.	LI	210.
ER	0.94	PD	0.060	CR	12.		
HO	0.20	RH	0.060	V	53.		
DY	1.0	RU	0.060	TI	750.		

TABLE B-33. LAB A--50% ORGANIC-PARR BOMBED LOG (X_m/X_A)

U	-0. 200	TB	0. 030	MO	9999.	SC	-0. 500
TH	-0. 510	GD	9999.	NB	9999.	CA	-0. 190
BI	9999.	EU	-0. 210	ZR	-0. 870	K	-0. 660
PB	-0. 140	SM	-0. 480	Y	-0. 240	CL	-1. 270
TL	0. 000	ND	9999.	SR	-0. 300	S	9999.
HG	9999.	PR	9999.	RB	-0. 470	P	9999.
AU	9999.	CE	-0. 330	BR	-0. 600	SI	-1. 310
PT	9999.	LA	-0. 370	SE	-0. 020	AL	-0. 510
IR	9999.	BA	-0. 190	AS	-0. 070	MG	-0. 480
OS	9999.	CS	-0. 930	GE	9999.	NA	-0. 730
RE	9999.	I	-1. 790	GA	9999.	F	9999.
W	-0. 280	TE	9999.	ZN	-0. 700	O	9999.
TA	-1. 090	SB	-0. 210	CU	-0. 480	N	9999.
HF	-0. 890	SN	9999.	NI	-1. 210	C	9999.
LU	-0. 820	IN	9999.	CO	-0. 540	B	9999.
YB	-0. 470	CD	-0. 170	FE	-0. 350	BE	0. 15
TM	9999.	AG	-0. 900	MN	-0. 220	LI	9999.
ER	9999.	PD	9999.	CR	-0. 620		
HO	9999.	RH	9999.	V	-0. 250		
DY	9999.	RU	9999.	TI	-0. 590		

TABLE B-34. LAB A--50% ORGANIC-PARR BOMBED-NORMALIZED

U	220.	TB	1. 6	MO	9. 6	SC	100.
TH	6. 0	GD	4. 0	NB	1. 2	CA	24000.
BI	6. 4	EU	1. 2	ZR	32.	K	2800.
PB	820.	SM	3. 2	Y	28.	CL	36.
TL	3. 2	ND	19.	SR	680.	S	6400.
HG	0. 000	PR	9. 4	RB	34.	P	340.
AU	0. 12	CE	1080.	BR	2. 4	SI	8200.
PT	0. 12	LA	26.	SE	240.	AL	30000.
IR	0. 12	BA	1360.	AS	820.	MG	4800.
OS	0. 12	CS	0. 80	GE	5. 2	NA	480.
RE	0. 000	I	1. 2	GA	11.	F	112.
W	1. 9	TE	0. 20	ZN	34.	O	0. 000
TA	0. 12	SB	3. 4	CU	34.	N	0. 000
HF	0. 80	SN	2. 0	NI	4. 8	C	0. 000
LU	0. 12	IN	0. 000	CO	9. 6	B	124.
YB	1. 9	CD	0. 80	FE	22000.	BE	14.
TM	0. 12	AG	240.	MN	240.	LI	420.
ER	1. 9	PD	0. 12	CR	24.		
HO	0. 40	RH	0. 12	V	106.		
DY	2. 0	RU	0. 12	TI	1500.		

TABLE B-35. LAB A-90% ORGANIC-NEAT-RUN 1

U	17.	TB	0.17	MO	2.6	SC	27.
TH	2.4	GD	2.7	NB	3.2	CA	4000.
BI	3.5	EU	0.78	ZR	22.	K	2400.
PB	70.	SM	1.4	Y	1.9	CL	63.
TL	1.4	ND	1.4	SR	140.	S	110.
HG	0.000	PR	3.2	RB	11.	P	240.
AU	0.52	CE	170.	BR	1.2	SI	10000.
PT	1.5	LA	7.1	SE	6.6	AL	10000.
IR	0.81	BA	150.	AS	9.2	MG	5000.
OS	1.3	CS	0.65	GE	0.70	NA	460.
RE	0.000	I	0.73	GA	3.1	F	6.8
W	0.69	TE	0.10	ZN	21.	O	0.000
TA	0.63	SB	1.2	CU	18.	N	0.000
HF	2.0	SN	0.66	NI	3.9	C	0.000
LU	0.20	IN	0.000	CO	7.3	B	140.
YB	0.99	CD	0.26	FE	4800.	BE	0.58
TM	0.72	AG	0.64	MN	74.	LI	17.
ER	1.2	PD	1.0	CR	6.6		
HO	0.20	RH	0.90	V	30.		
DY	0.77	RU	0.85	TI	370.		

TABLE B-36. LAB A--90% ORGANIC-NEAT-RUN 1-LOG (X_m/X_A)

U	-0. 320	TB	0. 050	MO	9999.	SC	-0. 070
TH	0. 080	GD	9999.	NB	9999.	CA	0. 020
BI	9999.	EU	0. 59	ZR	-0. 040	K	0. 27
PB	-0. 210	SM	0. 15	Y	-0. 410	CL	-0. 030
TL	0. 64	ND	9999.	SR	0. 010	S	9999.
HG	9999.	PR	9999.	RB	0. 030	P	9999.
AU	9999.	CE	-0. 140	BR	0. 090	SI	-0. 220
PT	9999.	LA	0. 030	SE	-0. 580	AL	0. 000
IR	9999.	BA	-0. 160	AS	-1. 020	MG	0. 52
OS	9999.	CS	-0. 020	GE	9999.	NA	0. 25
RE	9999.	I	-1. 020	GA	9999.	F	9999.
W	0. 27	TE	9999.	ZN	0. 080	O	9999.
TA	0. 62	SB	0. 33	CU	0. 24	N	9999.
HF	0. 49	SN	9999.	NI	-0. 300	C	9999.
LU	0. 39	IN	9999.	CO	0. 33	B	9999.
YB	0. 24	CD	0. 34	FE	-0. 010	BE	-0. 210
TM	9999.	AG	-2. 480	MN	0. 26	LI	9999.
ER	9999.	PD	9999.	CR	-0. 180		
HO	9999.	RH	9999.	V	0. 20		
DY	9999.	RU	9999.	TI	-0. 200		

TABLE B-37. LAB A--90% ORGANIC-NEAT-RUN 1-NORMALIZED

U	170.	TB	1. 7	MO	26.	SC	270.
TH	24.	GD	27.	NB	32.	CA	40000.
BI	35.	EU	7. 8	ZR	220.	K	24000.
PB	700.	SM	14.	Y	19.	CL	630.
TL	14.	ND	14.	SR	1400.	S	1100.
HG	0. 000	PR	32.	RB	110.	P	2400.
AU	5. 2	CE	1700.	BR	12.	SI	100000.
PT	15.	LA	71.	SE	66.	AL	100000.
IR	8. 1	BA	1500.	AS	92.	MG	50000.
OS	13.	CS	6. 5	GE	7. 0	NA	4600.
RE	0. 000	I	7. 3	GA	31.	F	68.
W	6. 9	TE	1. 0	ZN	210.	O	0. 000
TA	6. 3	SB	12.	CU	180.	N	0. 000
HF	20.	SN	6. 6	NI	39.	C	0. 000
LU	2. 0	IN	0. 000	CO	73.	B	1400.
YB	9. 9	CD	2. 6	FE	48000.	BE	5. 8
TM	7. 2	AG	6. 4	MN	740.	LI	170.
ER	12.	PD	10.	CR	66.		
HO	2. 0	RH	9. 0	V	300.		
DY	7. 7	RU	8. 5	TI	3700.		

TABLE B-38. LAB A--90% ORGANIC-NEAT-RUN 2

U	33.	TB	0. 10	MO	0. 52	SC	27.
TH	0. 36	GD	3. 4	NB	1. 2	CA	2400.
BI	0. 52	EU	0. 10	ZR	11.	K	460.
PB	160.	SM	0. 41	Y	0. 76	CL	12.
TL	0. 12	ND	0. 90	SR	39.	S	440.
HG	0. 000	PR	0. 14	RB	16.	P	85.
AU	0. 10	CE	120.	BR	0. 90	SI	4200.
PT	0. 10	LA	0. 72	SE	19.	AL	910.
IR	0. 10	BA	58.	AS	92.	MG	420.
OS	0. 10	CS	1. 7	GE	0. 52	NA	56.
RE	0. 000	I	0. 51	GA	1. 2	F	1. 3
W	0. 46	TE	0. 12	ZN	5. 9	O	0. 000
TA	0. 26	SB	0. 52	CU	4. 4	N	0. 000
HF	0. 79	SN	0. 14	NI	1. 2	C	0. 000
LU	0. 10	IN	0. 000	CO	0. 70	B	25.
YB	0. 44	CD	0. 27	FE	620.	BE	0. 51
TM	0. 10	AG	3. 8	MN	9. 9	LI	16.
ER	0. 35	PD	0. 10	CR	5. 6		
HO	0. 10	RH	0. 10	V	11.		
DY	0. 27	RU	0. 10	TI	150.		

TABLE B-39. LAB A--90% ORGANIC-NEAT-RUN 2-LOG (X_m/X_A)

U	-0. 030	TB	-0. 170	MO	9999.	SC	-0. 070
TH	-0. 730	GD	9999.	NB	9999.	CA	-0. 190
BI	9999.	EU	-0. 290	ZR	-0. 340	K	-0. 440
PB	0. 14	SM	-0. 380	Y	-0. 810	CL	-0. 750
TL	-0. 420	ND	9999.	SR	-0. 540	S	9999.
HG	9999.	PR	9999.	RB	0. 20	P	9999.
AU	9999.	CE	-0. 290	BR	-0. 030	SI	-0. 600
PT	9999.	LA	-0. 960	SE	-0. 120	AL	-1. 030
IR	9999.	BA	-0. 570	AS	-0. 020	MG	-0. 540
OS	9999.	CS	0. 39	GE	9999.	NA	-0. 660
RE	9999.	I	-1. 180	GA	9999.	F	9999.
W	0. 090	TE	9999.	ZN	-0. 460	O	9999.
TA	0. 24	SB	-0. 020	CU	-0. 360	N	9999.
HF	0. 090	SN	9999.	NI	-0. 810	C	9999.
LU	0. 090	IN	9999.	CO	-0. 680	B	9999.
YB	-0. 100	CD	0. 35	FE	-0. 900	BE	-0. 270
TM	9999.	AG	-1. 700	MN	-0. 600	LI	9999.
ER	9999.	PD	9999.	CR	-0. 250		
HO	9999.	RH	9999.	V	-0. 230		
DY	9999.	RU	9999.	TI	-0. 590		

TABLE B-40. LAB A--90% ORGANIC-NEAT-RUN 2-NORMALIZED

U	330.	TB	1. 0	MO	5. 2	SC	270.
TH	3. 6	GD	34.	NB	12.	CA	24000.
BI	5. 2	EU	1. 0	ZR	110.	K	4600.
PB	1600.	SM	4. 1	Y	7. 6	CL	120.
TL	1. 2	ND	9. 0	SR	390.	S	4400.
HG	0. 000	PR	1. 4	RB	160.	P	850.
AU	1. 0	CE	1200.	BR	9. 0	SI	42000.
PT	1. 0	LA	7. 2	SE	190.	AL	9100.
IR	1. 0	BA	580.	AS	920.	MG	4200.
OS	1. 0	CS	17.	GE	5. 2	NA	560.
RE	0. 000	I	5. 1	GA	12.	F	13.
W	4. 6	TE	1. 2	ZN	59.	O	0. 000
TA	2. 6	SB	5. 2	CU	44.	N	0. 000
HF	7. 9	SN	1. 4	NI	12.	C	0. 000
LU	1. 0	IN	0. 000	CO	7. 0	B	250.
YB	4. 4	CD	2. 7	FE	6200.	BE	5. 1
TM	1. 0	AG	38.	MN	99.	LI	160.
ER	3. 5	PD	1. 0	CR	56.		
HO	1. 0	RH	1. 0	V	110.		
DY	2. 7	RU	1. 0	TI	1500.		

TABLE B-41. LAB A--90% ORGANIC-NEAT-AVERAGE OF RUNS 1 AND 2

U	25.	TB	0. 14	MO	1. 6	SC	27.
TH	1. 4	GD	3. 1	NB	2. 2	CA	3200.
BI	2. 0	EU	0. 44	ZR	17.	K	1430.
PB	115.	SM	0. 91	Y	1. 3	CL	38.
TL	0. 76	ND	1. 2	SR	90.	S	275.
HG	0. 000	PR	1. 7	RB	14.	P	163.
AU	0. 31	CE	145.	BR	1. 1	SI	7100.
PT	0. 80	LA	3. 9	SE	13.	AL	5455.
IR	0. 46	BA	104.	AS	51.	MG	2710.
OS	0. 70	CS	1. 2	GE	0. 61	NA	258.
RE	0. 000	I	0. 62	GA	2. 2	F	4. 1
W	0. 58	TE	0. 11	ZN	13.	O	0. 000
TA	0. 45	SB	0. 86	CU	11.	N	0. 000
HF	1. 4	SN	0. 40	NI	2. 6	C	0. 000
LU	0. 15	IN	0. 000	CO	4. 0	B	83.
YB	0. 72	CD	0. 27	FE	2710.	BE	0. 55
TM	0. 41	AG	2. 2	MN	42.	LI	17.
ER	0. 78	PD	0. 55	CR	6. 1		
HO	0. 15	RH	0. 50	V	21.		
DY	0. 52	RU	0. 48	TI	260.		

TABLE B-42. LAB A--90% ORGANIC-NEAT-AVERAGE-LOG (X_m/X_A)

U	-0. 150	TB	-0. 020	MO	9999.	SC	-0. 070
TH	-0. 140	GD	9999.	NB	9999.	CA	-0. 060
BI	9999.	EU	0. 34	ZR	-0. 150	K	0. 040
PB	0. 000	SM	-0. 030	Y	-0. 580	CL	-0. 250
TL	0. 38	ND	9999.	SR	-0. 180	S	9999.
HG	9999.	PR	9999.	RB	0. 14	P	9999.
AU	9999.	CE	-0. 210	BR	0. 050	SI	-0. 370
PT	9999.	LA	-0. 230	SE	-0. 290	AL	-0. 250
IR	9999.	BA	-0. 320	AS .	-0. 270	MG	0. 26
OS	9999.	CS	0. 23	GE	9999.	NA	0. 000
RE	9999.	I	-1. 100	GA	9999.	F	9999.
W	0. 20	TE	9999.	ZN	-0. 120	O	9999.
TA	0. 48	SB	0. 19	CU	0. 020	N	9999.
HF	0. 34	SN	9999.	NI	-0. 480	C	9999.
LU	0. 27	IN	9999.	CO	0. 070	B	9999.
YB	0. 10	CD	0. 35	FE	-0. 260	BE	-0. 240
TM	9999.	AG	-1. 940	MN	0. 020	LI	9999.
ER	9999.	PD	9999.	CR	-0. 220		
HO	9999.	RH	9999.	V	0. 040		
DY	9999.	RU	9999.	TI	-0. 360		

TABLE B-43. LAB A--90% ORGANIC-NEAT-NORMALIZED

U	250.	TB	1.4	MO	16.	SC	270.
TH	14.	GD	31.	NB	22.	CA	32000.
BI	20.	EU	4.4	ZR	170.	K	14300.
PB	1150.	SM	9.1	Y	13.	CL	380.
TL	7.6	ND	12.	SR	900.	S	2750.
HG	0.000	PR	17.	RB	140.	P	1630.
AU	3.1	CE	1450.	BR	11.	SI	71000.
PT	8.0	LA	39.	SE	130.	AL	54550.
IR	4.6	BA	1040.	AS	510.	MG	27100.
OS	7.0	CS	12.	GE	6.1	NA	2580.
RE	0.000	I	6.2	GA	22.	F	41.
W	5.8	TE	1.1	ZN	130.	O	0.000
TA	4.5	SB	8.6	CU	110.	N	0.000
HF	14.	SN	4.0	NI	26.	C	0.000
LU	1.5	IN	0.000	CO	40.	B	830.
YB	7.2	CD	2.7	FE	27100.	BE	5.5
TM	4.1	AG	22.	MN	420.	LI	170.
ER	7.8	PD	5.5	CR	61.		
HO	1.5	RH	5.0	V	210.		
DY	5.2	RU	4.8	TI	2600.		

TABLE B-44. LAB A--90% ORGANIC-NEAT-STANDARD DEVIATION

U	11.	TB	0. 050	MO	1. 5	SC	0. 000
TH	1. 4	GD	0. 50	NB	1. 4	CA	1131.
BI	2. 1	EU	0. 48	ZR	7. 8	K	1372.
PB	64.	SM	0. 70	Y	0. 81	CL	36.
TL	0. 91	ND	0. 36	SR	71.	S	233.
HG	999999.	PR	2. 2	RB	3. 6	P	110.
AU	0. 30	CE	35.	BR	0. 22	SI	4101.
PT	0. 99	LA	4. 5	SE	8. 8	AL	6428.
IR	0. 50	BA	65.	AS	59.	MG	3239.
OS	0. 85	CS	0. 74	GE	0. 13	NA	286.
RE	999999.	I	0. 16	GA	1. 3	F	3. 9
W	0. 16	TE	0. 014	ZN	11.	O	999999.
TA	0. 26	SB	0. 48	CU	9. 6	N	999999.
HF	0. 86	SN	0. 37	NI	1. 9	C	999999.
LU	0. 071	IN	999999.	CO	4. 7	B	81.
YB	0. 39	CD	0. 010	FE	2956.	BE	0. 050
TM	0. 44	AG	2. 2	MN	45.	LI	1. 0
ER	0. 60	PD	0. 64	CR	0. 71		
HO	0. 071	RH	0. 57	V	13.		
DY	0. 35	RU	0. 53	TI	156.		

TABLE B-45. LAB A--90% ORGANIC-NEAT-RSD

U	0. 45	TB	0. 36	MO	0. 92	SC	0. 000
TH	1. 0	GD	0. 16	NB	0. 64	CA	0. 35
BI	1. 1	EU	1. 1	ZR	0. 46	K	0. 96
PB	0. 55	SM	0. 77	Y	0. 62	CL	0. 95
TL	1. 2	ND	0. 30	SR	0. 79	S	0. 85
HG	999999.	PR	1. 3	RB	0. 26	P	0. 67
AU	0. 96	CE	0. 24	BR	0. 20	SI	0. 58
PT	1. 2	LA	1. 2	SE	0. 67	AL	1. 2
IR	1. 1	BA	0. 63	AS	1. 1	MG	1. 2
OS	1. 2	CS	0. 62	GE	0. 21	NA	1. 1
RE	999999.	I	0. 25	GA	0. 61	F	0. 95
W	0. 28	TE	0. 13	ZN	0. 82	O	999999.
TA	0. 58	SB	0. 56	CU	0. 87	N	999999.
HF	0. 61	SN	0. 92	NI	0. 73	C	999999.
LU	0. 47	IN	999999.	CO	1. 2	B	0. 98
YB	0. 54	CD	0. 037	FE	1. 1	BE	0. 091
TM	1. 1	AG	1. 0	MN	1. 1	LI	0. 059
ER	0. 77	PD	1. 2	CR	0. 12		
HO	0. 47	RH	1. 1	V	0. 64		
DY	0. 68	RU	1. 1	TI	0. 60		

TABLE B-46. LAB A--90% ORGANIC-PARR BOMBED

U	6. 9	TB	0. 060	MO	1. 1	SC	5. 9
TH	0. 40	GD	0. 30	NB	0. 10	CA	1400.
BI	0. 30	EU	0. 060	ZR	1. 9	K	1600.
PB	21.	SM	0. 30	Y	1. 4	CL	6. 2
TL	0. 20	ND	0. 20	SR	32.	S	230.
HG	0. 000	PR	0. 30	RB	2. 3	P	69.
AU	0. 060	CE	38.	BR	0. 50	SI	2100.
PT	0. 060	LA	0. 63	SE	4. 1	AL	3100.
IR	0. 060	BA	44.	AS	69.	MG	3400.
OS	0. 060	CS	0. 060	GE	0. 30	NA	280.
RE	0. 000	I	0. 30	GA	0. 63	F	13.
W	0. 20	TE	0. 060	ZN	8. 8	O	0. 000
TA	0. 060	SB	0. 30	CU	4. 3	N	0. 000
HF	0. 30	SN	0. 50	NI	1. 4	C	0. 000
LU	0. 060	IN	0. 000	CO	0. 60	B	26.
YB	0. 20	CD	0. 060	FE	750.	BE	0. 40
TM	0. 060	AG	14.	MN	14.	LI	0. 000
ER	0. 10	PD	0. 060	CR	1. 9		
HO	0. 060	RH	0. 060	V	4. 7		
DY	0. 20	RU	0. 060	TI	44.		

TABLE B-47. LAB A--90% ORGANIC-PARR BOMBED-LOG (X_m/X_A)

U	-0. 710	TB	-0. 390	MO	9999.	SC	-0. 730
TH	-0. 690	GD	9999.	NB	9999.	CA	-0. 420
BI	9999.	EU	-0. 510	ZR	-1. 100	K	0. 090
PB	-0. 730	SM	-0. 510	Y	-0. 540	CL	-1. 040
TL	-0. 190	ND	9999.	SR	-0. 620	S	9999.
HG	9999.	PR	9999.	RB	-0. 640	P	9999.
AU	9999.	CE	-0. 790	BR	-0. 280	SI	-0. 900
PT	9999.	LA	-1. 020	SE	-0. 790	AL	-0. 500
IR	9999.	BA	-0. 690	AS	-0. 140	MG	0. 36
OS	9999.	CS	-1. 060	GE	9999.	NA	0. 030
RE	9999.	I	-1. 410	GA	9999.	F	9999.
W	-0. 260	TE	9999.	ZN	-0. 290	O	9999.
TA	-0. 390	SB	-0. 260	CU	-0. 370	N	9999.
HF	-0. 320	SN	9999.	NI	-0. 750	C	9999.
LU	-0. 120	IN	9999.	CO	-0. 740	B	9999.
YB	-0. 440	CD	-0. 290	FE	-0. 810	BE	-0. 370
TM	9999.	AG	-1. 140	MN	-0. 450	LI	9999.
ER	9999.	PD	9999.	CR	-0. 720		
HO	9999.	RH	9999.	V	-0. 600		
DY	9999.	RU	9999.	TI	-1. 130		

TABLE B-48. LAB A--90% ORGANIC-PARR BOMBED-NORMALIZED

U	69.	TB	0. 60	MO	11.	SC	59.
TH	4. 0	GD	3. 0	NB	1. 0	CA	14000.
BI	3. 0	EU	0. 60	ZR	19.	K	16000.
PB	210.	SM	3. 0	Y	14.	CL	62.
TL	2. 0	ND	2. 0	SR	320.	S	2300.
HG	0. 000	PR	3. 0	RB	23.	P	690.
AU	0. 60	CE	380.	BR	5. 0	SI	21000.
PT	0. 60	LA	6. 3	SE	41.	AL	31000.
IR	0. 60	BA	440.	AS	690.	MG	34000.
OS	0. 60	CS	0. 60	GE	3. 0	NA	2800.
RE	0. 000	I	3. 0	GA	6. 3	F	130.
W	2. 0	TE	0. 60	ZN	88.	O	0. 000
TA	0. 60	SB	3. 0	CU	43.	N	0. 000
HF	3. 0	SN	5. 0	NI	14.	C	0. 000
LU	0. 60	IN	0. 000	CO	6. 0	B	260.
YB	2. 0	CD	0. 60	FE	7500.	BE	4. 0
TM	0. 60	AG	140.	MN	140.	LI	0. 000
ER	1. 0	PD	0. 60	CR	19.		
HO	0. 60	RH	0. 60	V	47.		
DY	2. 0	RU	0. 60	TI	440.		

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TABLE B-49. LAB A--FLY ASH-NEAT-RUN 1

U	6. 6	TB	0. 70	MO	12.	SC	0. 000
TH	37.	GD	3. 0	NB	36.	CA	73000.
BI	1. 1	EU	1. 5	ZR	520.	K	4800.
PB	72.	SM	11.	Y	150.	CL	140.
TL	6. 1	ND	35.	SR	2900.	S	4600.
HG	0. 000	PR	16.	RB	110.	P	1100.
AU	0. 39	CE	180.	BR	14.	SI	38000.
PT	0. 000	LA	120.	SE	13.	AL	12000.
IR	0. 60	BA	3400.	AS	93.	MG	2700.
OS	0. 65	CS	5. 2	GE	19.	NA	530.
RE	0. 41	I	0. 63	GA	42.	F	330.
W	1. 6	TE	1. 1	ZN	210.	O	0. 000
TA	0. 000	SB	8. 5	CU	140.	N	0. 000
HF	7. 0	SN	10.	NI	240.	C	0. 000
LU	1. 3	IN	0. 000	CO	59.	B	640.
YB	1. 9	CD	1. 9	FE	57000.	BE	5. 0
TM	0. 58	AG	0. 000	MN	240.	LI	210.
ER	4. 2	PD	0. 81	CR	59.		
HO	0. 76	RH	0. 11	V	350.		
DY	3. 0	RU	0. 33	TI	4300.		

TABLE B-50. LAB A-FLY ASH-NEAT-RUN 1-LOG (X_m/X_A)

U	-0. 230	TB	-0. 420	MO	-0. 310	SC	9999.
TH	0. 19	GD	9999.	NB	0. 11	CA	0. 19
BI	9999.	EU	-0. 210	ZR	0. 24	K	-0. 540
PB	0. 010	SM	-0. 040	Y	0. 38	CL	0. 52
TL	0. 18	ND	9999.	SR	0. 32	S	9999.
HG	9999.	PR	9999.	RB	0. 000	P	9999.
AU	9999.	CE	0. 090	BR	0. 070	SI	-0. 730
PT	9999.	LA	0. 17	SE	0. 14	AL	-1. 010
IR	9999.	BA	0. 10	AS	0. 18	MG	-0. 810
OS	9999.	CS	-0. 210	GE	-0. 130	NA	-0. 770
RE	9999.	I	-0. 650	GA	0. 010	F	9999.
W	-0. 450	TE	9999.	ZN	0. 000	O	9999.
TA	9999.	SB	0. 090	CU	0. 040	N	9999.
HF	-0. 040	SN	0. 30	NI	0. 39	C	9999.
LU	0. 11	IN	9999.	CO	0. 19	B	9999.
YB	-0. 560	CD	0. 12	FE	-0. 030	BE	-0. 370
TM	9999.	AG	9999.	MN	-0. 300	LI	9999.
ER	9999.	PD	9999.	CR	-0. 340		
HO	9999.	RH	9999.	V	0. 21		
DY	9999.	RU	9999.	TI	-0. 230		

TABLE B-51. NBS SRM 1633 FLY ASH-CERTIFIED VALUES

U	12.	TB	1. 9	MO	25.	SC	27.
TH	24.	GD	0. 000	NB	28.	CA	47000.
BI	0. 000	EU	2. 5	ZR	301.	K	17200.
PB	70.	SM	12.	Y	62.	CL	42.
TL	4. 0	ND	0. 000	SR	1380.	S	0. 000
HG	0. 14	PR	0. 000	RB	112.	P	0. 000
AU	0. 000	CE	146.	BR	12.	SI	210000.
PT	0. 000	LA	82.	SE	9. 4	AL	127000.
IR	0. 000	BA	2700.	AS	61.	MG	18000.
OS	0. 000	CS	8. 6	GE	26.	NA	3200.
RE	0. 000	I	2. 9	GA	41.	F	0. 000
W	4. 6	TE	0. 000	ZN	210.	O	0. 000
TA	1. 8	SB	6. 9	CU	128.	N	0. 000
HF	7. 9	SN	5. 0	NI	98.	C	0. 000
LU	1. 0	IN	0. 32	CO	38.	B	0. 000
YB	7. 0	CD	1. 5	FE	62000.	BE	12.
TM	0. 000	AG	0. 000	MN	493.	LI	0. 000
ER	0. 000	PD	0. 000	CR	131.		
HO	0. 000	RH	0. 000	V	214.		
DY	0. 000	RU	0. 000	TI	7400.		

TABLE B-52. SPIKED SRM 1633-CALCULATED TRUE VALUES

U	360.	TB	1.5	MO	0.000	SC	326.
TH	20.	GD	0.000	NB	0.000	CA	38000.
BI	0.000	EU	2.0	ZR	245.	K	13000.
PB	1160.	SM	10.	Y	50.	CL	690.
TL	3.2	ND	0.000	SR	1380.	S	0.000
HG	0.000	PR	0.000	RB	102.	P	0.000
AU	0.000	CE	2390.	BR	9.8	SI	170000.
PT	0.000	LA	67.	SE	257.	AL	100000.
IR	0.000	BA	2200.	AS	980.	MG	15000.
OS	0.000	CS	7.0	GE	0.000	NA	2610.
RE	0.000	I	79.	GA	0.000	F	0.000
W	3.7	TE	0.000	ZN	176.	O	0.000
TA	1.5	SB	5.6	CU	104.	N	0.000
HF	6.4	SN	0.000	NI	80.	C	0.000
LU	0.81	IN	0.000	CO	34.	B	0.000
YB	5.7	CD	1.2	FE	50000.	BE	9.7
TM	0.000	AG	1960.	MN	404.	LI	0.000
ER	0.000	PD	0.000	CR	103.		
HO	0.000	RH	0.000	V	191.		
DY	0.000	RU	0.000	TI	6030.		

TABLE B-53. LAB B--0% ORGANIC-NEAT

U	170.	TB	2. 4	MO	36.	SC	86.
TH	26.	GD	35.	NB	64.	CA	24200.
BI	2. 7	EU	3. 6	ZR	305.	K	15600.
PB	1330.	SM	13.	Y	39.	CL	5. 7
TL	8. 6	ND	47.	SR	3310.	S	386.
HG	4. 5	PR	11.	RB	183.	P	240.
AU	4. 5	CE	1960.	BR	25.	SI	126000.
PT	8. 6	LA	50.	SE	185.	AL	77000.
IR	4. 0	BA	4660.	AS	640.	MG	5400.
OS	4. 6	CS	14.	GE	30.	NA	1600.
RE	2. 7	I	73.	GA	103.	F	500.
W	17.	TE	4. 0	ZN	232.	O	0. 000
TA	15.	SB	15.	CU	147.	N	0. 000
HF	10.	SN	11.	NI	98.	C	0. 000
LU	0. 60	IN	0. 000	CO	38.	B	157.
YB	6. 5	CD	9. 0	FE	28400.	BE	74.
TM	1. 2	AG	18.	MN	463.	LI	9. 0
ER	0. 000	PD	14.	CR	190.		
HO	2. 4	RH	2. 0	V	194.		
DY	20.	RU	7. 6	TI	4100.		

TABLE B-54. LAB B-0% ORGANIC-NEAT-LOG (X_m/X_A)

U	-0. 320	TB	0. 20	MO	9999.	SC	-0. 570
TH	0. 11	GD	9999.	NB	9999.	CA	-0. 190
BI	9999.	EU	0. 26	ZR	0. 10	K	0. 080
PB	0. 060	SM	0. 11	Y	-0. 100	CL	-2. 070
TL	0. 43	ND	9999.	SR	0. 38	S	9999.
HG	9999.	PR	9999.	RB	0. 25	P	9999.
AU	9999.	CE	-0. 080	BR	0. 41	SI	-0. 120
PT	9999.	LA	-0. 120	SE	-0. 130	AL	-0. 100
IR	9999.	BA	0. 33	AS	-0. 180	MG	-0. 430
OS	9999.	CS	0. 30	GE	9999.	NA	-0. 200
RE	9999.	I	-0. 020	GA	9999.	F	9999.
W	0. 66	TE	9999.	ZN	0. 12	O	9999.
TA	1. 0	SB	0. 43	CU	0. 15	N	9999.
HF	0. 19	SN	9999.	NI	0. 090	C	9999.
LU	-0. 120	IN	9999.	CO	0. 050	B	9999.
YB	0. 060	CD	0. 88	FE	-0. 240	BE	0. 88
TM	9999.	AG	-2. 030	MN	0. 060	LI	9999.
ER	9999.	PD	9999.	CR	0. 27		
HO	9999.	RH	9999.	V	0. 010		
DY	9999.	RU	9999.	TI	-0. 160		

TABLE B-55. LAB B--10% ORGANIC-NEAT

U	314.	TB	1. 8	MO	35.	SC	150.
TH	18.	GD	18.	NB	74.	CA	25000.
BI	1. 2	EU	2. 1	ZR	478.	K	11000.
PB	624.	SM	7. 2	Y	34.	CL	24.
TL	4. 3	ND	36.	SR	3650.	S	270.
HG	3. 1	PR	9. 3	RB	130.	P	290.
AU	3. 1	CE	1810.	BR	27.	SI	96400.
PT	6. 0	LA	48.	SE	250.	AL	26000.
IR	2. 8	BA	3930.	AS	1060.	MG	6000.
OS	4. 5	CS	13.	GE	25.	NA	1025.
RE	2. 2	I	45.	GA	104.	F	430.
W	15.	TE	2. 2	ZN	340.	O	0. 000
TA	4. 6	SB	7. 1	CU	170.	N	0. 000
HF	8. 0	SN	8. 5	NI	110.	C	0. 000
LU	0. 40	IN	0. 000	CO	61.	B	275.
YB	4. 5	CD	9. 7	FE	32000.	BE	40.
TM	1. 1	AG	1330.	MN	340.	LI	11.
ER	0. 000	PD	8. 6	CR	120.		
HO	1. 6	RH	1. 6	V	186.		
DY	18.	RU	3. 8	TI	4700.		

TABLE B-56. LAB B--10% ORGANIC-NEAT-LOG (X_m/X_A)

U	-0. 010	TB	0. 12	MO	9999.	SC	-0. 290
TH	0. 000	GD	9999.	NB	9999.	CA	-0. 130
BI	9999.	EU	0. 060	ZR	0. 33	K	-0. 020
PB	-0. 220	SM	-0. 090	Y	-0. 120	CL	-1. 410
TL	0. 17	ND	9999.	SR	0. 46	S	9999.
HG	9999.	PR	9999.	RB	0. 15	P	9999.
AU	9999.	CE	-0. 070	BR	0. 48	SI	-0. 190
PT	9999.	LA	-0. 090	SE	0. 030	AL	-0. 530
IR	9999.	BA	0. 29	AS	0. 080	MG	-0. 350
OS	9999.	CS	0. 31	GE	9999.	NA	-0. 350
RE	9999.	I	-0. 190	GA	9999.	F	9999.
W	0. 65	TE	9999.	ZN	0. 33	O	9999.
TA	0. 53	SB	0. 14	CU	0. 25	N	9999.
HF	0. 14	SN	9999.	NI	0. 18	C	9999.
LU	-0. 260	IN	9999.	CO	0. 30	B	9999.
YB	-0. 050	CD	0. 95	FE	-0. 140	BE	0. 66
TM	9999.	AG	-0. 120	MN	-0. 020	LI	9999.
ER	9999.	PD	9999.	CR	0. 11		
HO	9999.	RH	9999.	V	0. 030		
DY	9999.	RU	9999.	TI	-0. 060		

TABLE B-57. LAB B--10% ORGANIC-NEAT-NORMALIZED

U	345.	TB	2. 0	MO	39.	SC	165.
TH	20.	GD	20.	NB	81.	CA	27500.
BI	1. 3	EU	2. 3	ZR	526.	K	12100.
PB	686.	SM	7. 9	Y	37.	CL	26.
TL	4. 7	ND	40.	SR	4015.	S	297.
HG	3. 4	PR	10.	RB	143.	P	319.
AU	3. 4	CE	1991.	BR	30.	SI	106040.
PT	6. 6	LA	53.	SE	275.	AL	28600.
IR	3. 1	BA	4323.	AS	1166.	MG	6600.
OS	5. 0	CS	14.	GE	28.	NA	1128.
RE	2. 4	I	50.	GA	114.	F	473.
W	17.	TE	2. 4	ZN	374.	O	0. 000
TA	5. 1	SB	7. 8	CU	187.	N	0. 000
HF	8. 8	SN	9. 4	NI	121.	C	0. 000
LU	0. 44	IN	0. 000	CO	67.	B	303.
YB	5. 0	CD	11.	FE	35200.	BE	44.
TM	1. 2	AG	1463.	MN	374.	LI	12.
ER	0. 000	PD	9. 5	CR	132.		
HO	1. 8	RH	1. 8	V	205.		
DY	20.	RU	4. 2	TI	5170.		

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TABLE B-58. LAB B--50% ORGANIC-NEAT

U	109.	TB	2.3	MO	25.	SC	180.
TH	9.1	GD	27.	NB	54.	CA	18700.
BI	2.6	EU	2.0	ZR	337.	K	12000.
PB	535.	SM	4.4	Y	12.	CL	2.8
TL	4.6	ND	20.	SR	1230.	S	335.
HG	3.0	PR	4.3	RB	58.	P	440.
AU	3.0	CE	1000.	BR	25.	SI	146000.
PT	5.8	LA	23.	SE	90.	AL	63000.
IR	5.4	BA	2170.	AS	306.	MG	5700.
OS	9.0	CS	5.4	GE	22.	NA	1200.
RE	4.1	I	56.	GA	84.	F	1460.
W	27.	TE	3.9	ZN	125.	O	0.000
TA	20.	SB	7.1	CU	102.	N	0.000
HF	6.9	SN	6.2	NI	92.	C	0.000
LU	0.40	IN	0.000	CO	60.	B	465.
YB	3.5	CD	14.	FE	31800.	BE	36.
TM	1.6	AG	11.	MN	290.	LI	15.
ER	0.000	PD	13.	CR	660.		
HO	1.6	RH	3.5	V	175.		
DY	11.	RU	5.9	TI	6680.		

TABLE B-59. LAB B--50% ORGANIC-NEAT-LOG (X_m/X_A)

U	-0. 210	TB	0. 49	MO	9999.	SC	0. 040
TH	-0. 030	GD	9999.	NB	9999.	CA	0. 000
BI	9999.	EU	0. 30	ZR	0. 44	K	0. 27
PB	-0. 030	SM	-0. 050	Y	-0. 310	CL	-2. 080
TL	0. 46	ND	9999.	SR	0. 25	S	9999.
HG	9999.	PR	9999.	RB	0. 060	P	9999.
AU	9999.	CE	-0. 070	BR	0. 71	SI	0. 23
PT	9999.	LA	-0. 160	SE	-0. 140	AL	0. 10
IR	9999.	BA	0. 30	AS	-0. 190	MG	-0. 110
OS	9999.	CS	0. 19	GE	9999.	NA	-0. 030
RE	9999.	I	0. 15	GA	9999.	F	9999.
W	1. 2	TE	9999.	ZN	0. 15	O	9999.
TA	1. 4	SB	0. 40	CU	0. 29	N	9999.
HF	0. 33	SN	9999.	NI	0. 36	C	9999.
LU	0. 000	IN	9999.	CO	0. 55	B	9999.
YB	0. 090	CD	1. 4	FE	0. 10	BE	0. 87
TM	9999.	AG	-1. 940	MN	0. 16	LI	9999.
ER	9999.	PD	9999.	CR	1. 1		
HO	9999.	RH	9999.	V	0. 26		
DY	9999.	RU	9999.	TI	0. 35		

TABLE B-60. LAB B--50% ORGANIC-NEAT-NORMALIZED

U	218.	TB	4.6	MO	50.	SC	360.
TH	18.	GD	54.	NB	108.	CA	37400.
BI	5.2	EU	4.0	ZR	674.	K	24000.
PB	1070.	SM	8.8	Y	24.	CL	5.6
TL	9.2	ND	40.	SR	2460.	S	670.
HG	6.0	PR	8.6	RB	116.	P	880.
AU	6.0	CE	2000.	BR	50.	SI	292000.
PT	12.	LA	45.	SE	180.	AL	126000.
IR	11.	BA	4340.	AS	612.	MG	11400.
OS	18.	CS	11.	GE	44.	NA	2400.
RE	8.2	I	112.	GA	168.	F	2920.
W	54.	TE	7.8	ZN	250.	O	0.000
TA	40.	SB	14.	CU	204.	N	0.000
HF	14.	SN	12.	NI	184.	C	0.000
LU	0.80	IN	0.000	CO	120.	B	930.
YB	7.0	CD	28.	FE	63600.	BE	72.
TM	3.2	AG	22.	MN	580.	LI	30.
ER	0.000	PD	26.	CR	1320.		
HO	3.2	RH	7.0	V	350.		
DY	22.	RU	12.	TI	13360.		

TABLE B-61. LAB B--90% ORGANIC-LTA

U	12.	TB	0. 60	MO	6. 0	SC	14.
TH	2. 0	GD	7. 3	NB	10.	CA	2030.
BI	0. 50	EU	0. 30	ZR	77.	K	1880.
PB	124.	SM	1. 4	Y	3. 0	CL	1. 0
TL	1. 1	ND	3. 9	SR	245.	S	100.
HG	1. 4	PR	0. 80	RB	11.	P	91.
AU	1. 4	CE	16.	BR	14.	SI	18500.
PT	2. 7	LA	3. 5	SE	21.	AL	12000.
IR	1. 3	BA	376.	AS	32.	MG	1470.
OS	5. 7	CS	1. 1	GE	3. 6	NA	240.
RE	1. 6	I	5. 0	GA	11.	F	373.
W	6. 7	TE	1. 4	ZN	75.	O	0. 000
TA	0. 80	SB	1. 4	CU	23.	N	0. 000
HF	1. 7	SN	1. 7	NI	18.	C	0. 000
LU	0. 14	IN	0. 000	CO	11.	B	55.
YB	1. 2	CD	4. 8	FE	3480.	BE	8. 0
TM	0. 60	AG	4. 2	MN	37.	LI	4. 5
ER	0. 000	PD	3. 9	CR	307.		
HO	0. 40	RH	1. 9	V	28.		
DY	3. 0	RU	5. 6	TI	820.		

TABLE B-62. LAB B--90% ORGANIC-LTA-LOG (X_m/X_A)

U	-0. 470	TB	0. 60	MO	9999.	SC	-0. 360
TH	0. 000	GD	9999.	NB	9999.	CA	-0. 260
BI	9999.	EU	0. 18	ZR	0. 50	K	0. 16
PB	0. 030	SM	0. 15	Y	-0. 210	CL	-1. 830
TL	0. 54	ND	9999.	SR	0. 25	S	9999.
HG	9999.	PR	9999.	RB	0. 030	P	9999.
AU	9999.	CE	-1. 180	BR	1. 2	SI	0. 040
PT	9999.	LA	-0. 270	SE	-0. 080	AL	0. 080
IR	9999.	BA	0. 23	AS	-0. 480	MG	0. 000
OS	9999.	CS	0. 20	GE	9999.	NA	-0. 030
RE	9999.	I	-0. 190	GA	9999.	F	9999.
W	1. 3	TE	9999.	ZN	0. 63	O	9999.
TA	0. 73	SB	0. 40	CU	0. 34	N	9999.
HF	0. 42	SN	9999.	NI	0. 35	C	9999.
LU	0. 24	IN	9999.	CO	0. 51	B	9999.
YB	0. 32	CD	1. 6	FE	-0. 150	BE	0. 92
TM	9999.	AG	-1. 660	MN	-0. 030	LI	9999.
ER	9999.	PD	9999.	CR	1. 5		
HO	9999.	RH	9999.	V	0. 17		
DY	9999.	RU	9999.	TI	0. 13		

TABLE B-63. LAB B--90% ORGANIC-LTA-NORMALIZED

U	120.	TB	6. 0	MO	60.	SC	140.
TH	20.	GD	73.	NB	100.	CA	20300.
BI	5. 0	EU	3. 0	ZR	770.	K	18800.
PB	1240.	SM	14.	Y	30.	CL	10.
TL	11.	ND	39.	SR	2450.	S	1000.
HG	14.	PR	9. 0	RB	110.	P	910.
AU	14.	CE	155.	BR	140.	SI	185000.
PT	27.	LA	35.	SE	210.	AL	120000.
IR	13.	BA	3760.	AS	320.	MG	14700.
OS	57.	CS	11.	GE	36.	NA	2400.
RE	16.	I	50.	GA	110.	F	3730.
W	67.	TE	14.	ZN	745.	O	0. 000
TA	8. 0	SB	14.	CU	230.	N	0. 000
HF	17.	SN	17.	NI	180.	C	0. 000
LU	1. 4	IN	0. 000	CO	110.	B	550.
YB	12.	CD	48.	FE	34800.	BE	80.
TM	6. 0	AG	42.	MN	370.	LI	45.
ER	0. 000	PD	39.	CR	3070.		
HO	4. 0	RH	19.	V	280.		
DY	30.	RU	56.	TI	8200.		

TABLE B-64. LAB C--0% ORGANIC-NEAT-RUN 1

U	640.	TB	3.4	MO	4.8	SC	230.
TH	48.	GD	10.	NB	21.	CA	73000.
BI	1.6	EU	3.6	ZR	390.	K	25000.
PB	1400.	SM	19.	Y	77.	CL	580.
TL	8.5	ND	78.	SR	2900.	S	540.
HG	0.000	PR	18.	RB	120.	P	1600.
AU	0.30	CE	2400.	BR	13.	SI	250000.
PT	0.000	LA	98.	SE	140.	AL	0.000
IR	0.92	BA	2100.	AS	750.	MG	47000.
OS	4.8	CS	16.	GE	160.	NA	16000.
RE	1.7	I	15.	GA	23.	F	51.
W	4.7	TE	0.29	ZN	250.	O	0.000
TA	0.000	SB	6.1	CU	190.	N	0.000
HF	7.2	SN	3.6	NI	120.	C	0.000
LU	0.67	IN	0.000	CO	52.	B	1000.
YB	14.	CD	2.5	FE	32000.	BE	2.7
TM	1.2	AG	1300.	MN	500.	LI	160.
ER	3.6	PD	1.1	CR	210.		
HO	2.4	RH	0.32	V	560.		
DY	6.6	RU	0.25	TI	9300.		

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TABLE B-65. LAB C--0% ORGANIC-NEAT-RUN 2

U	420.	TB	2. 2	MO	4. 3	SC	110.
TH	30.	GD	8. 7	NB	3. 3	CA	54000.
BI	1. 9	EU	2. 1	ZR	210.	K	8000.
PB	2100.	SM	9. 7	Y	47.	CL	370.
TL	6. 0	ND	35.	SR	2600.	S	510.
HG	0. 000	PR	8. 1	RB	110.	P	700.
AU	0. 094	CE	2200.	BR	12.	SI	110000.
PT	0. 000	LA	62.	SE	390.	AL	0. 000
IR	0. 14	BA	4000.	AS	700.	MG	7400.
OS	3. 0	CS	7. 0	GE	71.	NA	3800.
RE	1. 1	I	110.	GA	23.	F	16.
W	4. 2	TE	0. 79	ZN	230.	O	0. 000
TA	0. 000	SB	7. 6	CU	140.	N	0. 000
HF	2. 3	SN	2. 6	NI	74.	C	0. 000
LU	0. 86	IN	0. 000	CO	25.	B	173.
YB	18.	CD	1. 5	FE	14000.	BE	0. 42
TM	0. 75	AG	1200.	MN	320.	LI	72.
ER	2. 7	PD	0. 68	CR	67.		
HO	1. 0	RH	0. 37	V	180.		
DY	4. 0	RU	0. 078	TI	3400.		

TABLE B-66. LAB C--0% ORGANIC-NEAT-RUN 3

U	200.	TB	1. 5	MO	2. 0	SC	100.
TH	15.	GD	4. 0	NB	9. 2	CA	47000.
BI	0. 71	EU	1. 1	ZR	140.	K	22000.
PB	900.	SM	7. 3	Y	48.	CL	350.
TL	5. 9	ND	25.	SR	1200.	S	520.
HG	0. 000	PR	5. 7	RB	77.	P	1400.
AU	0. 13	CE	750.	BR	8. 2	SI	320000.
PT	0. 000	LA	43.	SE	130.	AL	0. 000
IR	0. 20	BA	2000.	AS	500.	MG	30000.
OS	0. 30	CS	4. 9	GE	49.	NA	10000.
RE	1. 1	I	13.	GA	16.	F	23.
W	2. 1	TE	0. 20	ZN	180.	O	0. 000
TA	0. 000	SB	2. 0	CU	64.	N	0. 000
HF	3. 2	SN	0. 59	NI	75.	C	0. 000
LU	0. 21	IN	0. 000	CO	34.	B	500.
YB	6. 3	CD	1. 1	FE	29000.	BE	1. 2
TM	0. 38	AG	1700.	MN	310.	LI	72.
ER	1. 9	PD	0. 48	CR	130.		
HO	1. 0	RH	0. 14	V	180.		
DY	2. 9	RU	0. 11	TI	2900.		

TABLE B-67. LAB C--0% ORGANIC-NEAT-AVERAGE OF RUNS 1 AND 3

U	420.	TB	2. 4	MO	3. 7	SC	147.
TH	31.	GD	7. 6	NB	11.	CA	58000.
BI	1. 4	EU	2. 3	ZR	247.	K	18333.
PB	1467.	SM	12.	Y	57.	CL	433.
TL	6. 8	ND	46.	SR	2233.	S	523.
HG	0. 000	PR	11.	RB	102.	P	1233.
AU	0. 17	CE	1783.	BR	11.	SI	226667.
PT	0. 000	LA	68.	SE	220.	AL	0. 000
IR	0. 42	BA	2700.	AS	650.	MG	28133.
OS	2. 7	CS	9. 3	GE	93.	NA	9933.
RE	1. 3	I	46.	GA	21.	F	30.
W	3. 7	TE	0. 43	ZN	220.	O	0. 000
TA	0. 000	SB	5. 2	CU	131.	N	0. 000
HF	12.	SN	2. 3	NI	90.	C	0. 000
LU	0. 67	IN	0. 000	CO	37.	B	514.
YB	13.	CD	1. 7	FE	25000.	BE	1. 4
TM	0. 78	AG	1400.	MN	377.	LI	101.
ER	2. 7	PD	0. 75	CR	136.		
HO	1. 5	RH	0. 28	V	307.		
DY	4. 7	RU	0. 15	TI	5200.		

TABLE B-68. LAB C--0% ORGANIC-NEAT-AVERAGE (RUNS 1 and 3)-LOG (X_m/X_A)

U	0.070	TB	0.20	MO	9999.	SC	-0.340
TH	0.19	GD	9999.	NB	9999.	CA	0.18
BI	9999.	EU	0.060	ZR	0.000	K	0.15
PB	0.10	SM	0.080	Y	0.060	CL	-0.190
TL	0.33	ND	9999.	SR	0.21	S	9999.
HG	9999.	PR	9999.	RB	0.000	P	9999.
AU	9999.	CE	-0.120	BR	0.050	SI	0.12
PT	9999.	LA	0.010	SE	-0.060	AL	9999.
IR	9999.	BA	0.090	AS	-0.170	MG	0.27
OS	9999.	CS	0.12	GE	9999.	NA	0.58
RE	9999.	I	-0.220	GA	9999.	F	9999.
W	0.000	TE	9999.	ZN	0.10	O	9999.
TA	9999.	SB	-0.020	CU	0.10	N	9999.
HF	0.27	SN	9999.	NI	0.050	C	9999.
LU	-0.070	IN	9999.	CO	0.040	B	9999.
YB	0.36	CD	0.15	FE	-0.290	BE	-0.830
TM	9999.	AG	-0.140	MN	-0.020	LI	9999.
ER	9999.	PD	9999.	CR	0.12		
HO	9999.	RH	9999.	V	0.21		
DY	9999.	RU	9999.	TI	-0.050		

TABLE B-69. LAB C--0% ORGANIC-NEAT-AVERAGE (M)-RUNS 1, 2, and 3

U	420.	TB	2. 4	MO	3. 7	SC	147.
TH	31.	GD	7. 6	NB	11.	CA	58000.
BI	1. 4	EU	2. 3	ZR	247.	K	18333.
PB	1467.	SM	12.	Y	57.	CL	433.
TL	6. 8	ND	46.	SR	2233.	S	523.
HG	0. 000	PR	11.	RB	102.	P	1233.
AU	0. 17	CE	1783.	BR	11.	SI	226667.
PT	0. 000	LA	68.	SE	220.	AL	0. 000
IR	0. 42	BA	2700.	AS	650.	MG	28133.
OS	2. 7	CS	9. 3	GE	93.	NA	9933.
RE	1. 3	I	46.	GA	21.	F	30.
W	3. 7	TE	0. 43	ZN	220.	O	0. 000
TA	0. 000	SB	5. 2	CU	131.	N	0. 000
HF	4. 2	SN	2. 3	NI	90.	C	0. 000
LU	0. 58	IN	0. 000	CO	37.	B	558.
YB	13.	CD	1. 7	FE	25000.	BE	1. 4
TM	0. 78	AG	1400.	MN	377.	LI	101.
ER	2. 7	PD	0. 75	CR	136.		
HO	1. 5	RH	0. 28	V	307.		
DY	4. 5	RU	0. 15	TI	5200.		

TABLE B-70. LAB C--0% ORGANIC-NEAT-AVERAGE (M) - LOG (X_m/X_A)

U	0. 070	TB	0. 20	MO	9999.	SC	-0. 340
TH	0. 19	GD	9999.	NB	9999.	CA	0. 18
BI	9999.	EU	0. 060	ZR	0. 000	K	0. 15
PB	0. 10	SM	0. 080	Y	0. 060	CL	-0. 190
TL	0. 33	ND	9999.	SR	0. 21	S	9999.
HG	9999.	PR	9999.	RB	0. 000	P	9999.
AU	9999.	CE	-0. 120	BR	0. 050	SI	0. 12
PT	9999.	LA	0. 010	SE	-0. 060	AL	9999.
IR	9999.	BA	0. 090	AS	-0. 170	MG	0. 27
OS	9999.	CS	0. 12	GE	9999.	NA	0. 58
RE	9999.	I	-0. 220	GA	9999.	F	9999.
W	0. 000	TE	9999.	ZN	0. 10	O	9999.
TA	9999.	SB	-0. 020	CU	0. 10	N	9999.
HF	-0. 170	SN	9999.	NI	0. 050	C	9999.
LU	-0. 140	IN	9999.	CO	0. 040	B	9999.
YB	0. 36	CD	0. 15	FE	-0. 290	BE	-0. 830
TM	9999.	AG	-0. 140	MN	-0. 020	LI	9999.
ER	9999.	PD	9999.	CR	0. 12		
HO	9999.	RH	9999.	V	0. 21		
DY	9999.	RU	9999.	TI	-0. 050		

TABLE B-71. LAB C--0% ORGANIC-NEAT-STANDARD DEVIATION (3 runs)

U	220.	TB	0. 96	MO	1. 5	SC	72.
TH	17.	GD	3. 2	NB	9. 0	CA	13454.
BI	0. 62	EU	1. 3	ZR	129.	K	9074.
PB	603.	SM	6. 2	Y	17.	CL	127.
TL	1. 5	ND	28.	SR	907.	S	15.
HG	999999.	PR	6. 5	RB	23.	P	473.
AU	0. 11	CE	900.	BR	2. 5	SI	106927.
PT	999999.	LA	28.	SE	147.	AL	999999.
IR	0. 43	BA	1127.	AS	132.	MG	19866.
OS	2. 3	CS	5. 9	GE	59.	NA	6100.
RE	0. 35	I	55.	GA	4. 1	F	19.
W	1. 4	TE	0. 32	ZN	36.	O	999999.
TA	999999.	SB	2. 9	CU	63.	N	999999.
HF	2. 6	SN	1. 5	NI	26.	C	999999.
LU	0. 33	IN	999999.	CO	14.	B	417.
YB	6. 0	CD	0. 72	FE	9644.	BE	1. 2
TM	0. 41	AG	265.	MN	107.	LI	51.
ER	0. 85	PD	0. 32	CR	72.		
HO	0. 81	RH	0. 12	V	219.		
DY	1. 9	RU	0. 092	TI	3559.		

TABLE B-72. LAB C--0% ORGANIC-NEAT-RSD (3 runs)

U	0. 52	TB	0. 40	MO	0. 40	SC	0. 49
TH	0. 53	GD	0. 42	NB	0. 82	CA	0. 23
BI	0. 44	EU	0. 55	ZR	0. 52	K	0. 49
PB	0. 41	SM	0. 51	Y	0. 30	CL	0. 29
TL	0. 22	ND	0. 61	SR	0. 41	S	0. 029
HG	999999.	PR	0. 59	RB	0. 22	P	0. 38
AU	0. 65	CE	0. 51	BR	0. 23	SI	0. 47
PT	999999.	LA	0. 41	SE	0. 67	AL	999999.
IR	1. 0	BA	0. 42	AS	0. 20	MG	0. 71
OS	0. 84	CS	0. 63	GE	0. 63	NA	0. 61
RE	0. 27	I	1. 2	GA	0. 19	F	0. 62
W	0. 37	TE	0. 74	ZN	0. 16	O	999999.
TA	999999.	SB	0. 56	CU	0. 48	N	999999.
HF	0. 62	SN	0. 67	NI	0. 29	C	999999.
LU	0. 58	IN	999999.	CO	0. 37	B	0. 75
YB	0. 46	CD	0. 42	FE	0. 39	BE	0. 83
TM	0. 53	AG	0. 19	MN	0. 28	LI	0. 50
ER	0. 32	PD	0. 42	CR	0. 53		
HO	0. 54	RH	0. 43	V	0. 71		
DY	0. 42	RU	0. 61	TI	0. 68		

TABLE B-73. LAB C--0% ORGANIC-NEAT-STANDARD DEVIATION (2 runs)

U	220.	TB	0.96	MO	1.5	SC	72.
TH	17.	GD	3.2	NB	9.0	CA	13454.
BI	0.62	EU	1.3	ZR	129.	K	9074.
PB	603.	SM	6.2	Y	17.	CL	127.
TL	1.5	ND	28.	SR	907.	S	15.
HG	0.000	PR	6.5	RB	23.	P	473.
AU	0.11	CE	900.	BR	2.5	SI	106927.
PT	0.000	LA	28.	SE	147.	AL	0.000
IR	0.43	BA	1127.	AS	132.	MG	19866.
OS	2.3	CS	5.9	GE	59.	NA	6100.
RE	0.35	I	55.	GA	4.1	F	19.
W	1.4	TE	0.32	ZN	36.	O	0.000
TA	0.000	SB	2.9	CU	63.	N	0.000
HF	12.	SN	1.5	NI	26.	C	0.000
LU	0.40	IN	0.000	CO	14.	B	480.
YB	6.0	CD	0.72	FE	9644.	BE	1.2
TM	0.41	AG	265.	MN	107.	LI	51.
ER	0.85	PD	0.32	CR	72.		
HO	0.81	RH	0.12	V	219.		
DY	3.9	RU	0.092	TI	3559.		

TABLE B-74. LAB C--0% ORGANIC-NEAT-RSD (2 runs)

U	0.52	TB	0.40	MO	0.40	SC	0.49
TH	0.53	GD	0.42	NB	0.82	CA	0.23
BI	0.44	EU	0.55	ZR	0.52	K	0.49
PB	0.41	SM	0.51	Y	0.30	CL	0.29
TL	0.22	ND	0.61	SR	0.41	S	0.029
HG	999999.	PR	0.59	RB	0.22	P	0.38
AU	0.65	CE	0.51	BR	0.23	SI	0.47
PT	999999.	LA	0.41	SE	0.67	AL	999999.
IR	1.0	BA	0.42	AS	0.20	MG	0.71
OS	0.84	CS	0.63	GE	0.63	NA	0.61
RE	0.27	I	1.2	GA	0.19	F	0.62
W	0.37	TE	0.74	ZN	0.16	O	999999.
TA	999999.	SB	0.56	CU	0.48	N	999999.
HF	0.97	SN	0.67	NI	0.29	C	999999.
LU	0.60	IN	999999.	CO	0.37	B	0.93
YB	0.46	CD	0.42	FE	0.39	BE	0.83
TM	0.53	AG	0.19	MN	0.28	LI	0.50
ER	0.32	PD	0.42	CR	0.53		
HO	0.54	RH	0.43	V	0.71		
DY	0.83	RU	0.61	TI	0.68		

TABLE B-75. LAB C--0% ORGANIC-NEAT-STANDARD DEVIATION (2 runs)

U	220.	TB	0. 96	MO	1. 5	SC	72.
TH	17.	GD	3. 2	NB	9. 0	CA	13454.
BI	0. 62	EU	1. 3	ZR	129.	K	9074.
PB	603.	SM	6. 2	Y	17.	CL	127.
TL	1. 5	ND	28.	SR	907.	S	15.
HG	999999.	PR	6. 5	RB	23.	P	473.
AU	0. 11	CE	900.	BR	2. 5	SI	106927.
PT	999999.	LA	28.	SE	147.	AL	999999.
IR	0. 43	BA	1127.	AS	132.	MG	19866.
OS	2. 3	CS	5. 9	GE	59.	NA	6100.
RE	0. 35	I	55.	GA	4. 1	F	19.
W	1. 4	TE	0. 32	ZN	36.	O	999999.
TA	999999.	SB	2. 9	CU	63.	N	999999.
HF	12.	SN	1. 5	NI	26.	C	999999.
LU	0. 40	IN	999999.	CO	14.	B	480.
YB	6. 0	CD	0. 72	FE	9644.	BE	1. 2
TM	0. 41	AG	265.	MN	107.	LI	51.
ER	0. 85	PD	0. 32	CR	72.		
HO	0. 81	RH	0. 12	V	219.		
DY	3. 9	RU	0. 092	TI	3559.		

TABLE B-76. LAB C--0% ORGANIC-NEAT-RSD (2 runs)

U	0. 52	TB	0. 40	MO	0. 40	SC	0. 49
TH	0. 53	GD	0. 42	NB	0. 82	CA	0. 23
BI	0. 44	EU	0. 55	ZR	0. 52	K	0. 49
PB	0. 41	SM	0. 51	Y	0. 30	CL	0. 29
TL	0. 22	ND	0. 61	SR	0. 41	S	0. 029
HG	999999.	PR	0. 59	RB	0. 22	P	0. 38
AU	0. 65	CE	0. 51	BR	0. 23	SI	0. 47
PT	999999.	LA	0. 41	SE	0. 67	AL	999999.
IR	1. 0	BA	0. 42	AS	0. 20	MG	0. 71
OS	0. 84	CS	0. 63	GE	0. 63	NA	0. 61
RE	0. 27	I	1. 2	GA	0. 19	F	0. 62
W	0. 37	TE	0. 74	ZN	0. 16	O	999999.
TA	999999.	SB	0. 56	CU	0. 48	N	999999.
HF	0. 97	SN	0. 67	NI	0. 29	C	999999.
LU	0. 60	IN	999999.	CO	0. 37	B	0. 93
YB	0. 46	CD	0. 42	FE	0. 39	BE	0. 83
TM	0. 53	AG	0. 19	MN	0. 28	LI	0. 50
ER	0. 32	PD	0. 42	CR	0. 53		
HO	0. 54	RH	0. 43	V	0. 71		
DY	0. 83	RU	0. 61	TI	0. 68		

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TABLE B-77. LAB C--0% ORGANIC-PARR BOMBED

U	380.	TB	4.0	MO	5.8	SC	25.
TH	10.	GD	3.0	NB	1.5	CA	16000.
BI	1.3	EU	1.1	ZR	42.	K	860.
PB	520.	SM	4.8	Y	16.	CL	21.
TL	1.3	ND	16.	SR	810.	S	320.
HG	0.000	PR	2.7	RB	8.8	P	160.
AU	0.18	CE	520.	BR	0.73	SI	4500.
PT	0.000	LA	21.	SE	280.	AL	7100.
IR	0.27	BA	2600.	AS	330.	MG	840.
OS	0.39	CS	1.2	GE	65.	NA	220.
RE	1.4	I	13.	GA	9.6	F	3.8
W	2.8	TE	0.74	ZN	30.	O	0.000
TA	0.000	SB	1.9	CU	31.	N	0.000
HF	2.3	SN	1.1	NI	18.	C	0.000
LU	0.28	IN	0.000	CO	7.8	B	9.9
YB	4.2	CD	2.9	FE	14000.	BE	0.14
TM	0.18	AG	560.	MN	210.	LI	1.4
ER	0.76	PD	0.38	CR	20.		
HO	1.4	RH	0.067	V	120.		
DY	2.7	RU	0.15	TI	880.		

TABLE B-78. LAB C--0% ORGANIC-PARR BOMBED-LOG (X_m/X_A)

U	0. 020	TB	0. 43	MO	9999.	SC	-1. 110
TH	-0. 290	GD	9999.	NB	9999.	CA	-0. 370
BI	9999.	EU	-0. 250	ZR	-0. 760	K	-1. 170
PB	-0. 340	SM	-0. 310	Y	-0. 480	CL	-1. 510
TL	-0. 380	ND	9999.	SR	-0. 220	S	9999.
HG	9999.	PR	9999.	RB	-1. 050	P	9999.
AU	9999.	CE	-0. 650	BR	-1. 120	SI	-1. 570
PT	9999.	LA	-0. 490	SE	0. 040	AL	-1. 140
IR	9999.	BA	0. 070	AS	-0. 460	MG	-1. 240
OS	9999.	CS	-0. 760	GE	9999.	NA	-1. 060
RE	9999.	I	-0. 770	GA	9999.	F	9999.
W	-0. 110	TE	9999.	ZN	-0. 760	O	9999.
TA	9999.	SB	-0. 460	CU	-0. 520	N	9999.
HF	-0. 430	SN	9999.	NI	-0. 640	C	9999.
LU	-0. 450	IN	9999.	CO	-0. 630	B	9999.
YB	-0. 120	CD	0. 38	FE	-0. 540	BE	-1. 830
TM	9999.	AG	-0. 530	MN	-0. 270	LI	9999.
ER	9999.	PD	9999.	CR	-0. 700		
HO	9999.	RH	9999.	V	-0. 190		
DY	9999.	RU	9999.	TI	-0. 830		

TABLE B-79. LAB C--10% ORGANIC-NEAT-RUN 1

U	450.	TB	2. 3	MO	4. 2	SC	57.
TH	65.	GD	13.	NB	14.	CA	41000.
BI	2. 9	EU	2. 5	ZR	200.	K	4100.
PB	2400.	SM	18.	Y	54.	CL	49.
TL	11.	ND	75.	SR	2000.	S	200.
HG	0. 000	PR	8. 7	RB	59.	P	190.
AU	0. 050	CE	2400.	BR	6. 2	SI	30000.
PT	0. 000	LA	69.	SE	150.	AL	0. 000
IR	0. 078	BA	3100.	AS	560.	MG	2800.
OS	8. 6	CS	11.	GE	76.	NA	500.
RE	2. 2	I	14.	GA	12.	F	6. 2
W	6. 0	TE	0. 72	ZN	140.	O	0. 000
TA	0. 000	SB	6. 1	CU	73.	N	0. 000
HF	6. 9	SN	2. 4	NI	60.	C	0. 000
LU	0. 64	IN	0. 000	CO	26.	B	22.
YB	37.	CD	1. 6	FE	16000.	BE	0. 23
TM	0. 75	AG	220.	MN	130.	LI	2. 4
ER	4. 6	PD	0. 26	CR	70.		
HO	3. 0	RH	0. 41	V	190.		
DY	12.	RU	0. 084	TI	1500.		

TABLE B-80. LAB C--10% ORGANIC-NEAT-RUN 2

U	1000.	TB	3.7	MO	4.7	SC	180.
TH	52.	GD	6.5	NB	23.	CA	65000.
BI	1.2	EU	1.8	ZR	320.	K	6900.
PB	21000.	SM	12.	Y	61.	CL	110.
TL	4.4	ND	41.	SR	2200.	S	440.
HG	0.000	PR	14.	RB	95.	P	600.
AU	0.081	CE	2800.	BR	7.2	SI	48000.
PT	0.000	LA	110.	SE	490.	AL	0.000
IR	0.13	BA	5000.	AS	300.	MG	4500.
OS	6.9	CS	6.1	GE	86.	NA	1200.
RE	1.7	I	66.	GA	20.	F	14.
W	5.1	TE	1.2	ZN	190.	O	0.000
TA	0.000	SB	3.3	CU	83.	N	0.000
HF	16.	SN	2.3	NI	64.	C	0.000
LU	0.74	IN	0.000	CO	21.	B	35.
YB	15.	CD	2.7	FE	18000.	BE	0.52
TM	3.5	AG	1000.	MN	190.	LI	44.
ER	4.4	PD	0.34	CR	110.		
HO	2.4	RH	0.18	V	210.		
DY	9.5	RU	0.27	TI	4200.		

TABLE B-81. LAB C--10% ORGANIC-NEAT-RUN 3

U	220.	TB	1. 6	MO	1. 6	SC	75.
TH	11.	GD	2. 9	NB	7. 0	CA	29000.
BI	1. 0	EU	1. 2	ZR	140.	K	2900.
PB	1400.	SM	7. 3	Y	27.	CL	94.
TL	5. 4	ND	26.	SR	1400.	S	190.
HG	0. 000	PR	6. 1	RB	56.	P	180.
AU	0. 036	CE	1700.	BR	6. 3	SI	29000.
PT	0. 000	LA	49.	SE	110.	AL	29000.
IR	0. 055	BA	2200.	AS	260.	MG	1300.
OS	0. 16	CS	5. 2	GE	54.	NA	970.
RE	0. 76	I	40.	GA	12.	F	4. 3
W	1. 6	TE	0. 21	ZN	21.	O	0. 000
TA	0. 000	SB	3. 1	CU	51.	N	0. 000
HF	0. 61	SN	1. 9	NI	28.	C	0. 000
LU	0. 23	IN	0. 000	CO	19.	B	32.
YB	9. 2	CD	0. 84	FE	15000.	BE	0. 23
TM	0. 28	AG	900.	MN	120.	LI	6. 6
ER	0. 51	PD	0. 68	CR	74.		
HO	1. 1	RH	0. 077	V	91.		
DY	2. 9	RU	0. 030	TI	2100.		

TABLE B-82. LAB C--10% ORGANIC-NEAT-AVERAGE OF RUNS 1, 2, and 3

U	557.	TB	2. 5	MO	3. 5	SC	104.
TH	43.	GD	7. 5	NB	15.	CA	45000.
BI	1. 7	EU	1. 8	ZR	220.	K	4633.
PB	8267.	SM	12.	Y	47.	CL	84.
TL	6. 9	ND	47.	SR	1867.	S	277.
HG	0. 000	PR	9. 6	RB	70.	P	323.
AU	0. 056	CE	2300.	BR	6. 6	SI	35667.
PT	0. 000	LA	76.	SE	250.	AL	0. 000
IR	0. 088	BA	3433.	AS	373.	MG	2867.
OS	5. 2	CS	7. 4	GE	72.	NA	890.
RE	1. 6	I	40.	GA	15.	F	8. 2
W	4. 2	TE	0. 71	ZN	117.	O	0. 000
TA	0. 000	SB	4. 2	CU	69.	N	0. 000
HF	7. 8	SN	2. 2	NI	51.	C	0. 000
LU	0. 54	IN	0. 000	CO	22.	B	30.
YB	20.	CD	1. 7	FE	16333.	BE	0. 33
TM	1. 5	AG	707.	MN	147.	LI	18.
ER	3. 2	PD	0. 43	CR	85.		
HO	2. 2	RH	0. 22	V	164.		
DY	8. 1	RU	0. 13	TI	2600.		

TABLE B-83. LAB C--10% ORGANIC-NEAT-AVERAGE-LOG (X_m/X_A)

U	0. 23	TB	0. 26	MO	9999.	SC	-0. 440
TH	0. 37	GD	9999.	NB	9999.	CA	0. 11
BI	9999.	EU	0. 000	ZR	0. 000	K	-0. 400
PB	0. 89	SM	0. 12	Y	0. 010	CL	-0. 860
TL	0. 38	ND	9999.	SR	0. 17	S	9999.
HG	9999.	PR	9999.	RB	-0. 110	P	9999.
AU	9999.	CE	0. 020	BR	-0. 120	SI	-0. 630
PT	9999.	LA	0. 10	SE	0. 030	AL	9999.
IR	9999.	BA	0. 23	AS	-0. 370	MG	-0. 670
OS	9999.	CS	0. 070	GE	9999.	NA	-0. 420
RE	9999.	I	-0. 240	GA	9999.	F	9999.
W	0. 10	TE	9999.	ZN	-0. 130	O	9999.
TA	9999.	SB	-0. 070	CU	-0. 130	N	9999.
HF	0. 13	SN	9999.	NI	-0. 140	C	9999.
LU	-0. 120	IN	9999.	CO	-0. 140	B	9999.
YB	0. 59	CD	0. 19	FE	-0. 430	BE	-1. 420
TM	9999.	AG	-0. 390	MN	-0. 390	LI	9999.
ER	9999.	PD	9999.	CR	-0. 030		
HO	9999.	RH	9999.	V	-0. 010		
DY	9999.	RU	9999.	TI	-0. 310		

TABLE B-84. LAB C--10% ORGANIC-NEAT-AVERAGE-NORMALIZED

U	613.	TB	2. 8	MO	3. 9	SC	114.
TH	47.	GD	8. 3	NB	17.	CA	49500.
BI	1. 9	EU	2. 0	ZR	242.	K	5096.
PB	9094.	SM	13.	Y	52.	CL	92.
TL	7. 6	ND	52.	SR	2054.	S	305.
HG	0. 000	PR	11.	RB	77.	P	355.
AU	0. 062	CE	2530.	BR	7. 3	SI	39234.
PT	0. 000	LA	84.	SE	275.	AL	0. 000
IR	0. 097	BA	3776.	AS	410.	MG	3154.
OS	5. 7	CS	8. 1	GE	79.	NA	979.
RE	1. 8	I	44.	GA	17.	F	9. 0
W	4. 6	TE	0. 78	ZN	129.	O	0. 000
TA	0. 000	SB	4. 6	CU	76.	N	0. 000
HF	8. 6	SN	2. 4	NI	56.	C	0. 000
LU	0. 59	IN	0. 000	CO	24.	B	33.
YB	22.	CD	1. 9	FE	17966.	BE	0. 36
TM	1. 7	AG	778.	MN	162.	LI	20.
ER	3. 5	PD	0. 47	CR	94.		
HO	2. 4	RH	0. 24	V	180.		
DY	8. 9	RU	0. 14	TI	2860.		

TABLE B-85. LAB C--10% ORGANIC-NEAT-STANDARD DEVIATION

U	401.	TB	1. 1	MO	1. 7	SC	66.
TH	28.	GD	5. 1	NB	8. 0	CA	18330.
BI	1. 0	EU	0. 65	ZR	92.	K	2053.
PB	11039.	SM	5. 4	Y	18.	CL	32.
TL	3. 6	ND	25.	SR	416.	S	142.
HG	999999.	PR	4. 0	RB	22.	P	240.
AU	0. 023	CE	557.	BR	0. 55	SI	10693.
PT	999999.	LA	31.	SE	209.	AL	999999.
IR	0. 038	BA	1429.	AS	163.	MG	1601.
OS	4. 5	CS	3. 1	GE	16.	NA	357.
RE	0. 73	I	26.	GA	4. 6	F	5. 1
W	2. 3	TE	0. 50	ZN	87.	O	999999.
TA	999999.	SB	1. 7	CU	16.	N	999999.
HF	7. 7	SN	0. 26	NI	20.	C	999999.
LU	0. 27	IN	999999.	CO	3. 6	B	6. 8
YB	15.	CD	0. 94	FE	1528.	BE	0. 17
TM	1. 7	AG	424.	MN	38.	LI	23.
ER	2. 3	PD	0. 22	CR	22.		
HO	0. 97	RH	0. 17	V	64.		
DY	4. 7	RU	0. 13	TI	1418.		

TABLE B-86. LAB C--10% ORGANIC-NEAT-RSD

U	0. 72	TB	0. 43	MO	0. 48	SC	0. 64
TH	0. 66	GD	0. 68	NB	0. 54	CA	0. 41
BI	0. 61	EU	0. 36	ZR	0. 42	K	0. 44
PB	1. 3	SM	0. 45	Y	0. 38	CL	0. 38
TL	0. 52	ND	0. 53	SR	0. 22	S	0. 51
HG	999999.	PR	0. 42	RB	0. 31	P	0. 74
AU	0. 41	CE	0. 24	BR	0. 084	SI	0. 30
PT	999999.	LA	0. 41	SE	0. 84	AL	999999.
IR	0. 44	BA	0. 42	AS	0. 44	MG	0. 56
OS	0. 86	CS	0. 42	GE	0. 23	NA	0. 40
RE	0. 46	I	0. 65	GA	0. 31	F	0. 63
W	0. 55	TE	0. 70	ZN	0. 74	O	999999.
TA	999999.	SB	0. 40	CU	0. 24	N	999999.
HF	0. 99	SN	0. 12	NI	0. 39	C	999999.
LU	0. 50	IN	999999.	CO	0. 16	B	0. 23
YB	0. 73	CD	0. 55	FE	0. 094	BE	0. 51
TM	1. 2	AG	0. 60	MN	0. 26	LI	1. 3
ER	0. 72	PD	0. 52	CR	0. 26		
HO	0. 44	RH	0. 78	V	0. 39		
DY	0. 58	RU	0. 97	TI	0. 55		

TABLE B-87. LAB C--10% ORGANIC-PARR BOMBED

U	140.	TB	2.1	MO	3.0	SC	52.
TH	3.9	GD	3.1	NB	0.80	CA	18000.
BI	0.50	EU	0.79	ZR	22.	K	330.
PB	420.	SM	5.9	Y	12.	CL	7.0
TL	0.66	ND	12.	SR	890.	S	170.
HG	0.000	PR	2.0	RB	8.9	P	59.
AU	0.092	CE	540.	BR	0.38	SI	2300.
PT	0.000	LA	15.	SE	73.	AL	5300.
IR	0.14	BA	2000.	AS	480.	MG	630.
OS	0.21	CS	0.86	GE	34.	NA	110.
RE	1.0	I	20.	GA	3.5	F	2.0
W	1.0	TE	0.20	ZN	31.	O	0.000
TA	0.000	SB	1.3	CU	32.	N	0.000
HF	1.2	SN	0.82	NI	13.	C	0.000
LU	0.15	IN	0.000	CO	5.8	B	11.
YB	3.1	CD	1.7	FE	7100.	BE	0.10
TM	0.13	AG	290.	MN	110.	LI	1.1
ER	0.66	PD	0.28	CR	10.		
HO	0.18	RH	0.071	V	43.		
DY	0.71	RU	0.077	TI	460.		

TABLE B-88. LAB C--10% ORGANIC-PARR BOMBED-LOG (X_m/X_A)

U	-0.360	TB	0.19	MO	9999.	SC	-0.750
TH	-0.660	GD	9999.	NB	9999.	CA	-0.270
BI	9999.	EU	-0.350	ZR	-1.000	K	-1.540
PB	-0.390	SM	-0.180	Y	-0.570	CL	-1.940
TL	-0.630	ND	9999.	SR	-0.140	S	9999.
HG	9999.	PR	9999.	RB	-1.010	P	9999.
AU	9999.	CE	-0.590	BR	-1.360	SI	-1.820

PT	9999.	LA	-0.600	SE	-0.500	AL	-1.220
IR	9999.	BA	0.000	AS	-0.260	MG	-1.330
OS	9999.	CS	-0.860	GE	9999.	NA	-1.320
RE	9999.	I	-0.550	GA	9999.	F	9999.
W	-0.520	TE	9999.	ZN	-0.700	O	9999.
TA	9999.	SB	-0.580	CU	-0.460	N	9999.
HF	-0.680	SN	9999.	NI	-0.740	C	9999.
LU	-0.680	IN	9999.	CO	-0.720	B	9999.
YB	-0.210	CD	0.19	FE	-0.800	BE	-1.940
TM	9999.	AG	-0.780	MN	-0.510	LI	9999.
ER	9999.	PD	9999.	CR	-0.960		
HO	9999.	RH	9999.	V	-0.600		
DY	9999.	RU	9999.	TI	-1.070		

TABLE B-89. LAB C-10% ORGANIC-PARR BOMBED-NORMALIZED

U	154.	TB	2. 3	MO	3. 3	SC	57.
TH	4. 3	GD	3. 4	NB	0. 88	CA	19800.
BI	0. 55	EU	0. 87	ZR	24.	K	363.
PB	462.	SM	6. 5	Y	13.	CL	7. 7
TL	0. 73	ND	13.	SR	979.	S	187.
HG	0. 000	PR	2. 2	RB	9. 8	P	65.
AU	0. 10	CE	594.	BR	0. 42	SI	2530.
PT	0. 000	LA	17.	SE	80.	AL	5830.
IR	0. 15	BA	2200.	AS	528.	MG	693.
OS	0. 23	CS	0. 95	GE	37.	NA	121.
RE	1. 1	I	22.	GA	3. 9	F	2. 2
W	1. 1	TE	0. 22	ZN	34.	O	0. 000
TA	0. 000	SB	1. 4	CU	35.	N	0. 000
HF	1. 3	SN	0. 90	NI	14.	C	0. 000
LU	0. 17	IN	0. 000	CO	6. 4	B	12.
YB	3. 4	CD	1. 9	FE	7810.	BE	0. 11
TM	0. 14	AG	319.	MN	121.	LI	1. 2
ER	0. 73	PD	0. 31	CR	11.		
HO	0. 20	RH	0. 078	V	47.		
DY	0. 78	RU	0. 085	TI	506.		

TABLE B-90. LAB C--50% ORGANIC-HF BOMBED

U	210.	TB	110.	MO	3. 3	SC	81.
TH	33.	GD	33.	NB	10.	CA	18000.
BI	0. 55	EU	2. 5	ZR	290.	K	3100.
PB	1200.	SM	15.	Y	36.	CL	280.
TL	3. 9	ND	54.	SR	2000.	S	94.
HG	0. 000	PR	13.	RB	42.	P	190.
AU	0. 072	CE	2500.	BR	1. 2	SI	77.
PT	0. 000	LA	66.	SE	41.	AL	0. 000
IR	0. 11	BA	3100.	AS	380.	MG	2900.
OS	0. 16	CS	7. 6	GE	4. 1	NA	740.
RE	0. 29	I	7. 3	GA	7. 7	F	1700.
W	1. 1	TE	0. 26	ZN	49.	O	0. 000
TA	0. 000	SB	2. 9	CU	66.	N	0. 000
HF	6. 9	SN	2. 4	NI	57.	C	0. 000
LU	0. 23	IN	0. 000	CO	19.	B	46.
YB	6. 9	CD	0. 38	FE	16000.	BE	0. 16
TM	0. 58	AG	170.	MN	320.	LI	3. 5
ER	1. 8	PD	6. 6	CR	68.		
HO	1. 5	RH	0. 59	V	97.		
DY	2. 7	RU	0. 060	TI	2200.		

TABLE B-91. LAB C--50% ORGANIC-HF BOMBED-LOG (X_m/X_A)

U	0. 070	TB	2. 2	MO	9999.	SC	-0. 290
TH	0. 52	GD	9999.	NB	9999.	CA	-0. 010
BI	9999.	EU	0. 40	ZR	0. 37	K	-0. 310
PB	0. 32	SM	0. 48	Y	0. 16	CL	-0. 080
TL	0. 39	ND	9999.	SR	0. 46	S	9999.
HG	9999.	PR	9999.	RB	-0. 070	P	9999.
AU	9999.	CE	0. 32	BR	-0. 600	SI	-3. 030
PT	9999.	LA	0. 29	SE	-0. 490	AL	9999.
IR	9999.	BA	0. 45	AS	-0. 100	MG	-0. 400
OS	9999.	CS	0. 34	GE	9999.	NA	-0. 240
RE	9999.	I	-0. 720	GA	9999.	F	9999.
W	-0. 220	TE	9999.	ZN	-0. 240	O	9999.
TA	9999.	SB	0. 020	CU	0. 10	N	9999.
HF	0. 33	SN	9999.	NI	0. 15	C	9999.
LU	-0. 240	IN	9999.	CO	0. 050	B	9999.
YB	0. 38	CD	-0. 190	FE	-0. 180	BE	-1. 470
TM	9999.	AG	-0. 750	MN	0. 20	LI	9999.
ER	9999.	PD	9999.	CR	0. 12		
HO	9999.	RH	9999.	V	0. 010		
DY	9999.	RU	9999.	TI	-0. 130		

TABLE B-92. LAB C--50% ORGANIC-HF BOMBED-NORMALIZED

U	420.	TB	220.	MO	6. 6	SC	162.
TH	66.	GD	66.	NB	20.	CA	36000.
BI	1. 1	EU	5. 0	ZR	580.	K	6200.
PB	2400.	SM	30.	Y	72.	CL	560.
TL	7. 8	ND	108.	SR	4000.	S	188.
HG	0. 000	PR	26.	RB	84.	P	380.
AU	0. 14	CE	5000.	BR	2. 4	SI	154.
PT	0. 000	LA	132.	SE	82.	AL	0. 000
IR	0. 22	BA	6200.	AS	760.	MG	5800.
OS	0. 32	CS	15.	GE	8. 2	NA	1480.
RE	0. 58	I	15.	GA	15.	F	3400.
W	2. 2	TE	0. 52	ZN	98.	O	0. 000
TA	0. 000	SB	5. 8	CU	132.	N	0. 000
HF	14.	SN	4. 8	NI	114.	C	0. 000
LU	0. 46	IN	0. 000	CO	38.	B	92.
YB	14.	CD	0. 76	FE	32000.	BE	0. 32
TM	1. 2	AG	340.	MN	640.	LI	7. 0
ER	3. 6	PD	13.	CR	136.		
HO	3. 0	RH	1. 2	V	194.		
DY	5. 4	RU	0. 12	TI	4400.		

TABLE B-93. LAB C--50% ORGANIC-LTA

U	130.	TB	0.65	MO	0.94	SC	32.
TH	9.1	GD	2.6	NB	4.0	CA	11000.
BI	0.31	EU	0.65	ZR	110.	K	4800.
PB	7700.	SM	3.6	Y	14.	CL	160.
TL	1.5	ND	15.	SR	790.	S	150.
HG	0.099	PR	3.5	RB	33.	P	300.
AU	0.029	CE	670.	BR	1.8	SI	48000.
PT	0.21	LA	19.	SE	21.	AL	0.000
IR	0.044	BA	1200.	AS	300.	MG	3200.
OS	0.064	CS	2.1	GE	26.	NA	1600.
RE	0.44	I	2.9	GA	3.4	F	2.4
W	0.90	TE	0.060	ZN	38.	O	0.000
TA	0.043	SB	1.2	CU	21.	N	0.000
HF	2.7	SN	0.57	NI	16.	C	0.000
LU	0.091	IN	27.	CO	7.5	B	26.
YB	3.7	CD	0.46	FE	13000.	BE	0.26
TM	0.16	AG	730.	MN	97.	LI	16.
ER	0.59	PD	0.46	CR	40.		
HO	0.42	RH	0.12	V	54.		
DY	1.2	RU	0.024	TI	1300.		

TABLE B-94. LAB C--50% ORGANIC-LTA-LOG (X_m/X_A)

U	-0. 130	TB	-0. 050	MO	9999.	SC	-0. 700
TH	-0. 030	GD	9999.	NB	9999.	CA	-0. 230
BI	9999.	EU	-0. 180	ZR	-0. 040	K	-0. 120
PB	1. 1	SM	-0. 130	Y	-0. 240	CL	-0. 320
TL	-0. 020	ND	9999.	SR	0. 060	S	9999.
HG	9999.	PR	9999.	RB	-0. 180	P	9999.
AU	9999.	CE	-0. 240	BR	-0. 420	SI	-0. 240
PT	9999.	LA	-0. 240	SE	-0. 780	AL	9999.
IR	9999.	BA	0. 040	AS	-0. 200	MG	-0. 360
OS	9999.	CS	-0. 210	GE	9999.	NA	0. 090
RE	9999.	I	-1. 120	GA	9999.	F	9999.
W	-0. 300	TE	9999.	ZN	-0. 350	O	9999.
TA	-1. 230	SB	-0. 360	CU	-0. 380	N	9999.
HF	-0. 060	SN	9999.	NI	-0. 390	C	9999.
LU	-0. 640	IN	9999.	CO	-0. 350	B	9999.
YB	0. 11	CD	-0. 110	FE	-0. 270	BE	-1. 260
TM	9999.	AG	-0. 120	MN	-0. 310	LI	9999.
ER	9999.	PD	9999.	CR	-0. 100		
HO	9999.	RH	9999.	V	-0. 240		
DY	9999.	RU	9999.	TI	-0. 360		

TABLE B-95. LAB C--50% ORGANIC-LTA-NORMALIZED

U	260.	TB	1. 3	MO	1. 9	SC	64.
TH	18.	GD	5. 2	NB	8. 0	CA	22000.
BI	0. 62	EU	1. 3	ZR	220.	K	9600.
PB	15400.	SM	7. 2	Y	28.	CL	320.
TL	3. 0	ND	30.	SR	1580.	S	300.
HG	0. 20	PR	7. 0	RB	66.	P	600.
AU	0. 058	CE	1340.	BR	3. 6	SI	96000.
PT	0. 42	LA	38.	SE	42.	AL	0. 000
IR	0. 088	BA	2400.	AS	600.	MG	6400.
OS	0. 13	CS	4. 2	GE	52.	NA	3200.
RE	0. 88	I	5. 8	GA	6. 8	F	4. 8
W	1. 8	TE	0. 12	ZN	76.	O	0. 000
TA	0. 086	SB	2. 4	CU	42.	N	0. 000
HF	5. 4	SN	1. 1	NI	32.	C	0. 000
LU	0. 18	IN	54.	CO	15.	B	52.
YB	7. 4	CD	0. 92	FE	26000.	BE	0. 52
TM	0. 32	AG	1460.	MN	194.	LI	32.
ER	1. 2	PD	0. 92	CR	80.		
HO	0. 84	RH	0. 24	V	108.		
DY	2. 4	RU	0. 048	TI	2600.		

TABLE B-96. LAB C--50% ORGANIC-NEAT-RUN 1

U	80.	TB	0. 21	MO	0. 38	SC	27.
TH	5. 7	GD	0. 38	NB	2. 5	CA	14000.
BI	0. 27	EU	0. 88	ZR	37.	K	4000.
PB	670.	SM	0. 99	Y	6. 5	CL	6. 2
TL	0. 96	ND	2. 4	SR	490.	S	71.
HG	0. 000	PR	1. 6	RB	0. 000	P	170.
AU	0. 018	CE	340.	BR	1. 1	SI	14000.
PT	0. 000	LA	8. 4	SE	38.	AL	0. 000
IR	0. 028	BA	1600.	AS	520.	MG	1300.
OS	0. 25	CS	2. 6	GE	38.	NA	340.
RE	0. 10	I	7. 3	GA	4. 4	F	1. 5
W	0. 28	TE	0. 091	ZN	11.	O	0. 000
TA	0. 000	SB	1. 0	CU	26.	N	0. 000
HF	1. 2	SN	0. 30	NI	10.	C	0. 000
LU	0. 11	IN	0. 000	CO	4. 7	B	23.
YB	1. 2	CD	0. 15	FE	10000.	BE	0. 12
TM	0. 051	AG	430.	MN	180.	LI	13.
ER	0. 22	PD	0. 15	CR	37.		
HO	0. 19	RH	0. 21	V	68.		
DY	2. 1	RU	0. 015	TI	1000.		

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TABLE B-97. LAB C--50% ORGANIC-NEAT-RUN 2

U	330.	TB	0. 20	MO	2. 4	SC	41.
TH	17.	GD	2. 7	NB	7. 1	CA	13000.
BI	1. 1	EU	1. 3	ZR	230.	K	1500.
PB	500.	SM	6. 5	Y	55.	CL	51.
TL	2. 3	ND	27.	SR	970.	S	100.
HG	0. 000	PR	6. 3	RB	43.	P	190.
AU	0. 073	CE	1200.	BR	1. 2	SI	22000.
PT	0. 000	LA	24.	SE	74.	AL	0. 000
IR	0. 11	BA	2200.	AS	90.	MG	1400.
OS	2. 4	CS	3. 8	GE	33.	NA	520.
RE	0. 83	I	3. 7	GA	8. 7	F	17.
W	2. 3	TE	0. 22	ZN	69.	O	0. 000
TA	0. 000	SB	3. 0	CU	53.	N	0. 000
HF	10.	SN	1. 7	NI	42.	C	0. 000
LU	0. 47	IN	0. 000	CO	13.	B	12.
YB	9. 9	CD	0. 85	FE	8000.	BE	0. 16
TM	0. 58	AG	460.	MN	250.	LI	20.
ER	1. 8	PD	0. 31	CR	34.		
HO	0. 58	RH	0. 056	V	69.		
DY	2. 3	RU	0. 11	TI	1500.		

TABLE B-98. LAB C--50% ORGANIC-NEAT-RUN 3

U	71.	TB	0. 38	MO	1. 1	SC	18.
TH	7. 6	GD	1. 2	NB	3. 3	CA	9600.
BI	0. 67	EU	0. 59	ZR	49.	K	5700.
PB	650.	SM	2. 1	Y	8. 6	CL	46.
TL	1. 1	ND	8. 8	SR	470.	S	64.
HG	0. 000	PR	2. 1	RB	28.	P	350.
AU	0. 024	CE	400.	BR	0. 74	SI	56000.
PT	0. 000	LA	16.	SE	27.	AL	58000.
IR	0. 037	BA	2000.	AS	88.	MG	5300.
OS	0. 053	CS	2. 5	GE	22.	NA	1900.
RE	0. 14	I	2. 4	GA	5. 9	F	8. 2
W	0. 75	TE	0. 14	ZN	16.	O	0. 000
TA	0. 000	SB	1. 4	CU	30.	N	0. 000
HF	3. 2	SN	0. 67	NI	19.	C	0. 000
LU	0. 15	IN	0. 000	CO	6. 2	B	7. 6
YB	4. 5	CD	0. 20	FE	10000.	BE	0. 15
TM	0. 14	AG	850.	MN	110.	LI	18.
ER	0. 69	PD	0. 28	CR	22.		
HO	0. 26	RH	0. 051	V	45.		
DY	1. 0	RU	0. 073	TI	1500.		

TABLE B-99. LAB C--50% ORGANIC-NEAT-AVERAGE OF RUNS 1, 2, and 3

U	160.	TB	0. 26	MO	1. 3	SC	29.
TH	10.	GD	1. 4	NB	4. 3	CA	12200.
BI	0. 68	EU	0. 92	ZR	105.	K	3733.
PB	607.	SM	3. 2	Y	23.	CL	34.
TL	1. 5	ND	13.	SR	643.	S	78.
HG	0. 000	PR	3. 3	RB	0. 000	P	237.
AU	0. 038	CE	647.	BR	1. 0	SI	30667.
PT	0. 000	LA	16.	SE	46.	AL	0. 000
IR	0. 058	BA	1933.	AS	233.	MG	2667.
OS	0. 90	CS	3. 0	GE	31.	NA	920.
RE	0. 36	I	4. 5	GA	6. 3	F	8. 9
W	1. 1	TE	0. 15	ZN	32.	O	0. 000
TA	0. 000	SB	1. 8	CU	36.	N	0. 000
HF	4. 8	SN	0. 89	NI	24.	C	0. 000
LU	0. 24	IN	0. 000	CO	8. 0	B	14.
YB	5. 2	CD	0. 40	FE	9333.	BE	0. 14
TM	0. 26	AG	580.	MN	180.	LI	17.
ER	0. 90	PD	0. 25	CR	31.		
HO	0. 34	RH	0. 11	V	61.		
DY	1. 8	RU	0. 066	TI	1333.		

TABLE B-100. LAB C--50% ORGANIC-NEAT-AVERAGE-LOG (X_m/X_A)

U	-0. 040	TB	-0. 450	MO	9999.	SC	-0. 740
TH	0. 000	GD	9999.	NB	9999.	CA	-0. 180
BI	9999.	EU	-0. 030	ZR	-0. 060	K	-0. 230
PB	0. 020	SM	-0. 180	Y	-0. 030	CL	-1. 000
TL	-0. 020	ND	9999.	SR	-0. 020	S	9999.
HG	9999.	PR	9999.	RB	9999.	P	9999.
AU	9999.	CE	-0. 260	BR	-0. 680	SI	-0. 430
PT	9999.	LA	-0. 310	SE	-0. 440	AL	9999.
IR	9999.	BA	0. 24	AS	-0. 310	MG	-0. 440
OS	9999.	CS	-0. 060	GE	9999.	NA	-0. 140
RE	9999.	I	-0. 930	GA	9999.	F	9999.
W	-0. 220	TE	9999.	ZN	-0. 430	O	9999.
TA	9999.	SB	-0. 180	CU	-0. 150	N	9999.
HF	0. 16	SN	9999.	NI	-0. 210	C	9999.
LU	-0. 220	IN	9999.	CO	-0. 320	B	9999.
YB	0. 26	CD	-0. 170	FE	-0. 420	BE	-1. 530
TM	9999.	AG	-0. 220	MN	-0. 040	LI	9999.
ER	9999.	PD	9999.	CR	-0. 210		
HO	9999.	RH	9999.	V	-0. 180		
DY	9999.	RU	9999.	TI	-0. 340		

TABLE B-101. LAB C--50% ORGANIC-NEAT-AVERAGE NORMALIZED

U	320.	TB	0. 52	MO	2. 6	SC	58.
TH	20.	GD	2. 8	NB	8. 6	CA	24400.
BI	1. 4	EU	1. 8	ZR	210.	K	7466.
PB	1214.	SM	6. 4	Y	46.	CL	68.
TL	3. 0	ND	26.	SR	1286.	S	156.
HG	0. 000	PR	6. 6	RB	0. 000	P	474.
AU	0. 076	CE	1294.	BR	2. 0	SI	61334.
PT	0. 000	LA	32.	SE	92.	AL	0. 000
IR	0. 12	BA	3866.	AS	466.	MG	5334.
OS	1. 8	CS	6. 0	GE	62.	NA	1840.
RE	0. 72	I	9. 0	GA	13.	F	18.
W	2. 2	TE	0. 30	ZN	64.	O	0. 000
TA	0. 000	SB	3. 6	CU	72.	N	0. 000
HF	9. 6	SN	1. 8	NI	48.	C	0. 000
LU	0. 48	IN	0. 000	CO	16.	B	28.
YB	10.	CD	0. 80	FE	18666.	BE	0. 28
TM	0. 52	AG	1160.	MN	360.	LI	34.
ER	1. 8	PD	0. 50	CR	62.		
HO	0. 68	RH	0. 22	V	122.		
DY	3. 6	RU	0. 13	TI	2666.		

TABLE B-102. LAB C--50% ORGANIC-NEAT-STANDARD DEVIATION

U	147.	TB	0. 10	MO	1. 0	SC	12.
TH	6. 1	GD	1. 2	NB	2. 5	CA	2307.
BI	0. 42	EU	0. 36	ZR	108.	K	2113.
PB	93.	SM	2. 9	Y	27.	CL	25.
TL	0. 74	ND	13.	SR	283.	S	19.
HG	999999.	PR	2. 6	RB	999999.	P	99.
AU	0. 030	CE	480.	BR	0. 24	SI	22301.
PT	999999.	LA	7. 8	SE	25.	AL	999999.
IR	0. 045	BA	306.	AS	249.	MG	2281.
OS	1. 3	CS	0. 72	GE	8. 2	NA	853.
RE	0. 41	I	2. 5	GA	2. 2	F	7. 8
W	1. 1	TE	0. 065	ZN	32.	O	999999.
TA	999999.	SB	1. 1	CU	15.	N	999999.
HF	4. 6	SN	0. 73	NI	17.	C	999999.
LU	0. 20	IN	999999.	CO	4. 4	B	7. 9
YB	4. 4	CD	0. 39	FE	1155.	BE	0. 021
TM	0. 28	AG	234.	MN	70.	LI	3. 6
ER	0. 81	PD	0. 085	CR	7. 9		
HO	0. 21	RH	0. 091	V	14.		
DY	0. 70	RU	0. 048	TI	289.		

TABLE B-103. LAB C--50% ORGANIC-NEAT-RSD

U	0. 92	TB	0. 39	MO	0. 79	SC	0. 40
TH	0. 61	GD	0. 84	NB	0. 57	CA	0. 19
BI	0. 61	EU	0. 39	ZR	1. 0	K	0. 57
PB	0. 15	SM	0. 91	Y	1. 2	CL	0. 72
TL	0. 49	ND	0. 98	SR	0. 44	S	0. 24
HG	999999.	PR	0. 78	RB	999999.	P	0. 42
AU	0. 79	CE	0. 74	BR	0. 24	SI	0. 73
PT	999999.	LA	0. 49	SE	0. 53	AL	999999.
IR	0. 78	BA	0. 16	AS	1. 1	MG	0. 86
OS	1. 4	CS	0. 24	GE	0. 26	NA	0. 93
RE	1. 1	I	0. 56	GA	0. 35	F	0. 87
W	0. 96	TE	0. 43	ZN	1. 0	O	999999.
TA	999999.	SB	0. 59	CU	0. 40	N	999999.
HF	0. 96	SN	0. 82	NI	0. 69	C	999999.
LU	0. 82	IN	999999.	CO	0. 55	B	0. 57
YB	0. 84	CD	0. 98	FE	0. 12	BE	0. 15
TM	1. 1	AG	0. 40	MN	0. 39	LI	0. 21
ER	0. 90	PD	0. 34	CR	0. 26		
HO	0. 61	RH	0. 82	V	0. 22		
DY	0. 39	RU	0. 73	TI	0. 22		

TABLE B-104. LAB C--50% ORGANIC-PARR BOMBED

U	71.	TB	0. 76	MO	2. 2	SC	26.
TH	2. 0	GD	1. 1	NB	0. 31	CA	4200.
BI	0. 25	EU	0. 22	ZR	9. 0	K	120.
PB	280.	SM	0. 80	Y	5. 9	CL	5. 5
TL	0. 47	ND	6. 0	SR	310.	S	93.
HG	0. 000	PR	1. 0	RB	6. 4	P	29.
AU	0. 066	CE	200.	BR	0. 27	SI	590.
PT	0. 000	LA	5. 4	SE	67.	AL	1900.
IR	0. 10	BA	470	AS	120.	MG	220.
OS	0. 15	CS	0. 43	GE	17.	NA	79.
RE	0. 54	I	1. 7	GA	1. 8	F	2. 0
W	1. 1	TE	0. 14	ZN	16.	O	0. 000
TA	0. 000	SB	0. 73	CU	8. 1	N	0. 000
HF	0. 87	SN	0. 42	NI	13.	C	0. 000
LU	0. 11	IN	0. 000	CO	2. 9	B	2. 6
YB	1. 1	CD	0. 55	FE	5100.	BE	0. 036
TM	0. 066	AG	290.	MN	39.	LI	0. 52
ER	0. 28	PD	0. 097	CR	8. 3		
HO	0. 52	RH	0. 036	V	22.		
DY	0. 73	RU	0. 055	TI	360.		

TABLE B-105. LAB C--50% ORGANIC-PARR BOMBED-LOG (X_m/X_A)

U	-0. 390	TB	0. 010	MO	9999.	SC	-0. 790
TH	-0. 690	GD	9999.	NB	9999.	CA	-0. 650
BI	9999.	EU	-0. 650	ZR	-1. 120	K	-1. 720
PB	-0. 310	SM	-0. 790	Y	-0. 620	CL	-1. 790
TL	-0. 520	ND	9999.	SR	-0. 340	S	9999.
HG	9999.	PR	9999.	RB	-0. 890	P	9999.
AU	9999.	CE	-0. 770	BR	-1. 250	SI	-2. 150
PT	9999.	LA	-0. 780	SE	-0. 270	AL	-1. 410
IR	9999.	BA	-0. 360	AS	-0. 600	MG	-1. 520
OS	9999.	CS	-0. 900	GE	9999.	NA	-1. 210
RE	9999.	I	-1. 360	GA	9999.	F	9999.
W	-0. 220	TE	9999.	ZN	-0. 730	O	9999.

TA	9999.	SB	-0. 570	CU	-0. 800	N	9999.
HF	-0. 560	SN	9999.	NI	-0. 480	C	9999.
LU	-0. 560	IN	9999.	CO	-0. 760	B	9999.
YB	-0. 400	CD	-0. 030	FE	-0. 680	BE	-2. 120
TM	9999.	AG	-0. 520	MN	-0. 700	LI	9999.
ER	9999.	PD	9999.	CR	-0. 780		
HO	9999.	RH	9999.	V	-0. 630		
DY	9999.	RU	9999.	TI	-0. 910		

TABLE B-106. LAB C--50% ORGANIC-PARR BOMBED-NORMALIZED

U	142.	TB	1. 5	MO	4. 4	SC	52.
TH	4. 0	GD	2. 2	NB	0. 62	CA	8400.
BI	0. 50	EU	0. 44	ZR	18.	K	240.
PB	560.	SM	1. 6	Y	12.	CL	11.
TL	0. 94	ND	12.	SR	620.	S	186.
HG	0. 000	PR	2. 0	RB	13.	P	58.
AU	0. 13	CE	400.	BR	0. 54	SI	1180.
PT	0. 000	LA	11.	SE	134.	AL	3800.
IR	0. 20	BA	940.	AS	240.	MG	440.
OS	0. 30	CS	0. 86	GE	34.	NA	158.
RE	1. 1	I	3. 4	GA	3. 6	F	4. 0
W	2. 2	TE	0. 28	ZN	32.	O	0. 000
TA	0. 000	SB	1. 5	CU	16.	N	0. 000
HF	1. 7	SN	0. 84	NI	26.	C	0. 000
LU	0. 22	IN	0. 000	CO	5. 8	B	5. 2
YB	2. 2	CD	1. 1	FE	10200.	BE	0. 072
TM	0. 13	AG	580.	MN	78.	LI	1. 0
ER	0. 56	PD	0. 19	CR	17.		
HO	1. 0	RH	0. 072	V	44.		
DY	1. 5	RU	0. 11	TI	720.		

TABLE B-107. LAB C--90% ORGANIC-LTA

U	42.	TB	0. 078	MO	0. 31	SC	7. 2
TH	3. 0	GD	0. 75	NB	1. 3	CA	3800.
BI	0. 14	EU	0. 21	ZR	20.	K	540.
PB	250.	SM	1. 2	Y	7. 0	CL	13.
TL	0. 42	ND	3. 5	SR	180.	S	17.
HG	0. 032	PR	1. 6	RB	5. 4	P	33.
AU	0. 009	CE	220.	BR	0. 29	SI	1900.
PT	0. 068	LA	6. 1	SE	10.	AL	0. 000
IR	0. 014	BA	280.	AS	33.	MG	350.
OS	0. 30	CS	0. 98	GE	5. 0	NA	130.
RE	0. 14	I	0. 48	GA	1. 1	F	0. 80
W	0. 42	TE	0. 028	ZN	8. 8	O	0. 000
TA	0. 014	SB	0. 38	CU	6. 8	N	0. 000
HF	0. 44	SN	0. 26	NI	5. 3	C	0. 000
LU	0. 085	IN	17.	CO	2. 4	B	3. 0
YB	1. 8	CD	0. 16	FE	2000.	BE	0. 042
TM	0. 075	AG	30.	MN	32.	LI	0. 44
ER	0. 31	PD	0. 055	CR	6. 7		
HO	0. 10	RH	0. 010	V	18.		
DY	0. 39	RU	0. 014	TI	580.		

TABLE B-108. LAB C--90% ORGANIC-LTA-LOG (X_m/X_A)

U	0. 070	TB	-0. 270	MO	9999.	SC	-0. 650
TH	0. 18	GD	9999.	NB	9999.	CA	0. 000
BI	9999.	EU	0. 020	ZR	-0. 080	K	-0. 370
PB	0. 33	SM	0. 080	Y	0. 15	CL	-0. 710
TL	0. 12	ND	9999.	SR	0. 12	S	9999.
HG	9999.	PR	9999.	RB	-0. 270	P	9999.
AU	9999.	CE	-0. 030	BR	-0. 520	SI	-0. 940
PT	9999.	LA	-0. 030	SE	-0. 400	AL	9999.
IR	9999.	BA	0. 10	AS	-0. 460	MG	-0. 620
OS	9999.	CS	0. 15	GE	9999.	NA	-0. 290
RE	9999.	I	-1. 210	GA	9999.	F	9999.
W	0. 060	TE	9999.	ZN	-0. 290	O	9999.
TA	-1. 020	SB	-0. 160	CU	-0. 170	N	9999.
HF	-0. 150	SN	9999.	NI	-0. 170	C	9999.
LU	0. 020	IN	9999.	CO	-0. 140	B	9999.
YB	0. 50	CD	0. 12	FE	-0. 390	BE	-1. 350
TM	9999.	AG	-0. 810	MN	-0. 090	LI	9999.
ER	9999.	PD	9999.	CR	-0. 180		
HO	9999.	RH	9999.	V	-0. 020		
DY	9999.	RU	9999.	TI	-0. 010		

TABLE B-109. LAB C--90% ORGANIC-LTA-NORMALIZED

U	420.	TB	0.78	MO	3.1	SC	72.
TH	30.	GD	7.5	NB	13.	CA	38000.
BI	1.4	EU	2.1	ZR	200.	K	5400.
PB	2500.	SM	12.	Y	70.	CL	130.
TL	4.2	ND	35.	SR	1800.	S	170.
HG	0.32	PR	16.	RB	54.	P	330.
AU	0.090	CE	2200.	BR	2.9	SI	19000.
PT	0.68	LA	61.	SE	100.	AL	0.000
IR	0.14	BA	2800.	AS	330.	MG	3500.
OS	3.0	CS	9.8	GE	50.	NA	1300.
RE	1.4	I	4.8	GA	11.	F	8.0
W	4.2	TE	0.28	ZN	88.	O	0.000
TA	0.14	SB	3.8	CU	68.	N	0.000
HF	4.4	SN	2.6	NI	53.	C	0.000
LU	0.65	IN	170.	CO	24.	B	30.
YB	18.	CD	1.6	FE	20000.	BE	0.42
TM	0.75	AG	300.	MN	320.	LI	4.4
ER	3.1	PD	0.55	CR	67.		
HO	1.0	RH	0.10	V	180.		
DY	3.9	RU	0.14	TI	5800.		

TABLE B-110. LAB C--90% ORGANIC-PARR BOMBED

U	4. 4	TB	0. 051	MO	0. 20	SC	0. 56
TH	0. 35	GD	0. 35	NB	0. 038	CA	250.
BI	0. 12	EU	0. 10	ZR	1. 2	K	120.
PB	23.	SM	0. 24	Y	0. 40	CL	2. 7
TL	0. 099	ND	0. 40	SR	9. 3	S	15.
HG	0. 000	PR	0. 048	RB	0. 41	P	21.
AU	0. 066	CE	17.	BR	0. 54	SI	210.
PT	0. 000	LA	0. 72	SE	8. 6	AL	2700.
IR	0. 10	BA	19.	AS	44.	MG	110.
OS	0. 15	CS	0. 082	GE	2. 3	NA	320.
RE	0. 094	I	1. 7	GA	0. 24	F	0. 12
W	0. 52	TE	0. 065	ZN	7. 1	O	0. 000
TA	0. 000	SB	0. 18	CU	1. 0	N	0. 000
HF	0. 87	SN	0. 15	NI	4. 7	C	0. 000
LU	0. 11	IN	0. 000	CO	0. 26	B	0. 63
YB	0. 80	CD	0. 037	FE	220.	BE	0. 004
TM	0. 066	AG	8. 8	MN	2. 4	LI	0. 067
ER	0. 16	PD	0. 069	CR	1. 9		
HO	0. 065	RH	0. 018	V	1. 9		
DY	0. 23	RU	0. 055	TI	18.		

TABLE B-111. LAB C--90% ORGANIC-PARR BOMBED-LOG (X_m/X_A)

U	-0. 900	TB	-0. 460	MO	9999.	SC	-1. 760
TH	-0. 750	GD	9999.	NB	9999.	CA	-1. 170
BI	9999.	EU	-0. 290	ZR	-1. 300	K	-1. 020
PB	-0. 690	SM	-0. 610	Y	-1. 090	CL	-1. 400
TL	-0. 500	ND	9999.	SR	-1. 160	S	9999.
HG	9999.	PR	9999.	RB	-1. 390	P	9999.
AU	9999.	CE	-1. 140	BR	-0. 250	SI	-1. 900
PT	9999.	LA	-0. 960	SE	-0. 470	AL	-0. 560
IR	9999.	BA	-1. 050	AS	-0. 340	MG	-1. 120
OS	9999.	CS	-0. 920	GE	9999.	NA	0. 090
RE	9999.	I	-0. 660	GA	9999.	F	9999.
W	0. 15	TE	9999.	ZN	-0. 380	O	9999.
TA	9999.	SB	-0. 480	CU	-1. 010	N	9999.
HF	0. 13	SN	9999.	NI	-0. 220	C	9999.
LU	0. 13	IN	9999.	CO	-1. 110	B	9999.
YB	0. 15	CD	-0. 500	FE	-1. 350	BE	-2. 370
TM	9999.	AG	-1. 340	MN	-1. 220	LI	9999.
ER	9999.	PD	9999.	CR	-0. 720		
HO	9999.	RH	9999.	V	-0. 990		
DY	9999.	RU	9999.	TI	-1. 520		

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TABLE B-112. LAB C--90% ORGANIC-PARR BOMBED-NORMALIZED

U	44.	TB	0.51	MO	2.0	SC	5.6
TH	3.5	GD	3.5	NB	0.38	CA	2500.
BI	1.2	EU	1.0	ZR	12.	K	1200.
PB	230.	SM	2.4	Y	4.0	CL	27.
TL	0.99	ND	4.0	SR	93.	S	150.
HG	0.000	PR	0.48	RB	4.1	P	210.
AU	0.66	CE	170.	BR	5.4	SI	2100.
PT	0.000	LA	7.2	SE	86.	AL	27000.
IR	1.0	BA	190.	AS	440.	MG	1100.
OS	1.5	CS	0.82	GE	23.	NA	3200.
RE	0.94	I	17.	GA	2.4	F	1.2
W	5.2	TE	0.65	ZN	71.	O	0.000
TA	0.000	SB	1.8	CU	10.	N	0.000
HF	8.7	SN	1.5	NI	47.	C	0.000
LU	1.1	IN	0.000	CO	2.6	B	6.3
YB	8.0	CD	0.37	FE	2200.	BE	0.040
TM	0.66	AG	88.	MN	24.	LI	0.67
ER	1.6	PD	0.69	CR	19.		
HO	0.65	RH	0.18	V	19.		
DY	2.3	RU	0.55	TI	180.		

APPENDIX C

ACCURACY ANALYSIS OF DATA

DATA FILE : B:AONEATA.LOG

LAB A - 0% ORGANICS - NO PREP - AVERAGE OF 2 DETERMINATIONS

```
LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

    LI       B        C        N        O        F        P        S        GA       GE
    NB       MO       RU       RH       PD       IN       SN       TE       PR       ND
    GD       DY       HO       ER       TM       RE       OS       IR       PT       AU
    HG       BI


20                                                 *
19                                                 *
18                                                 *
17                                                 *
16                                                 *
15                                                 *
14                                                 *
13                                                 *
12                                                 *
11                                                 *
10                                                 *                       TB
 9                                                 *                       EU
 8                                                 *                       SM
 7                                                 *                       CE
 6                                                 *               CD      LA
 5                                                 *TL             Y       BA
 4 FE                                              *BR             SE      SB
 3 CL                                      U       *NI     W       ZN      ZR              HF
 2 SI                              LU      K     AS*MN     AG      CO      SR      TH      CS      TA
 1 AL      CA      BE      I       YB      MG    SC*TI     CU      NA      V       PB      CR      RB
---+-------+-------+-------+-------+-------+-------+-------+-------+-------+-------+-------+-------+---
NO<-.6     -.5     -.4     -.3     -.2     -.1     0       0.1     0.2     0.3     0.4     0.5     >.6
```

```
DATA FILE : B:AOPARR.LOG

LAB A - 0% ORGANICS - PB PREP


 ***** OVERFLOW IN HISTOGRAM* ELEMENT PB IN COLUMN LE -0.6 OMITTED
LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

   LI    B     C     N     O     F     P     S     GA    GE
   NB    MO    RU    RH    PD    IN    SN    TE    PR    ND
   GD    DY    HO    ER    TM    RE    OS    IR    PT    AU
   HG    BI


20 TL                                    *
19 TA                                    *
18 HF                                    *
17 LU                                    *
16 YB                                    *
15 SM                                    *
14 LA                                    *
13 CS                                    *
12 I                                     *
11 SB                                    *
10 ZR                                    *
 9 BR                                    *
 8 ZN                                    *
 7 NI                                    *
 6 CR                                    *
 5 TI                      U             *
 4 CL                W     TH    BA      *
 3 SI          Y     EU    CD    SR    TB*
 2 AL    CE    FE    AG    K     AS    SE*MN
 1 NA    RB    SC    V     BE    CU    MG*CA             CO
---+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+---
NO<-.6  -.5   -.4   -.3   -.2   -.1    0    0.1   0.2   0.3   0.4   0.5   >.6
```

```
DATA FILE : B:A1ONEATA.LOG
```

LAB A - 10% ORGANICS - NO PREP - AVERAGE OF 2 DETERMINATIONS

```
LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

    LI    B     C     N     O     F     P     S     GA    GE
    NB    MO    RU    RH    PD    IN    SN    TE    PR    ND
    GD    DY    HO    ER    TM    RE    OS    IR    PT    AU
    HG    BI



20                                     *
19                                     *
18                                     *
17                                     *
16                                     *
15                                     *
14                                     *
13                                     *
12                                     *
11                                     *
10                                     *
 9                                     *     W
 8                                     *     YB
 7                                     *     TB    FB
 6 I                                   *     Y     HF
 5 AG                            LU    *     SR    CE
 4 FE                            AS    *     ZN    BA          TH
 3 CL                            SC  SE*     NI    SB          SM
 2 SI                      U     MG  MN*EU   CO    CD    LA    CS          TA
 1 AL    CA          TL    BR    BE  K *CU   TI    ZR    CR    V     NA    RB
---+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+--
NO<-.6   -.5   -.4   -.3   -.2   -.1    0    0.1   0.2   0.3   0.4   0.5   >.6
```

```
DATA FILE : B:A10PARR.LOG

LAB A - 10% ORGANICS - PB PREP


LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

   LI   B    C    N    O    F    P    S    GA   GE
   NB   MO   RU   RH   PD   IN   SN   TE   PR   ND
   GD   DY   HO   ER   TM   RE   OS   IR   PT   AU
   HG   BI


20                                *
19                                *
18                                *
17                                *
16                                *
15                                *
14                                *
13                                *
12                                *
11                                *
10                                *
 9                                *
 8 PB                           W *
 7 TL                           LA*
 6 TA                           BA*
 5 CS                       TH  SB*EU
 4 I                        YB  Y *CE  TB   MN
 3 AG             CO   HF   ZN  RB*SR  SM   V    AS
 2 NI             CR   LU   FE  TI*SE  CD   SC   AL
 1 CL   U    BR   SI   ZR   K   BE*CU  NA   CA   MG
  --+----+----+----+----+----+-----+----+----+----+----+----+----+--
NO<-.6  -.5  -.4  -.3  -.2  -.1   0   0.1  0.2  0.3  0.4  0.5  >.6
```

```
DATA FILE :  B:ASONEAT1.LOG

LAB A - 50% ORGANICS - NO PREP - RUN 1


LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

   LI    B     C     N     O     F     P     S     GA    GE
   NB    MO    RU    RH    PD    IN    SN    TE    PR    ND
   GD    DY    HO    ER    TM    RE    OS    IR    PT    AU
   HG    BI


20                                      *
19                                      *
18                                      *
17                                      *
16                                      *
15                                      *
14                                      *
13                                      *
12                                      *    W
11                                      *    HF
10                                      *    CE
 9                                      *    BA
 8                                      *    I
 7                                      *    ZR          TB
 6                                      *    Y           SM
 5 K                                    *    SR    TH    LA
 4 CL                      U            *    ZN    PB    SB                CS
 3 SI                TL    LU           *    NI    TA    CU                RB
 2 AL                AS    AG           *    SC    CD    CO                CR
 1 BE                FE    CA    SE   YB*BR  MG    TI    MN    EU    NA    V
---+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+--
NO<-.6  -.5   -.4   -.3   -.2   -.1     0    0.1   0.2   0.3   0.4   0.5   >.6
```

```
DATA FILE : B:A50NEAT2.LOG

LAB A - 50% ORGANICS - NO PREP - RUN 2


LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

   LI   B    C    N    O    F    P    S    GA   GE
   NB   MO   RU   RH   PD   IN   SN   TE   PR   ND
   GD   DY   HO   ER   TM   RE   OS   IR   PT   AU
   HG   BI



20                                *
19                                *
18                                *
17                                *
16                                *
15                                *
14                                *
13                                *
12                                *
11                                *
10                                *
 9 U                              *
 8 LA                             *
 7 I                              *
 6 AG                             *PB
 5 CR                  W          *TL
 4 K                   BA   TH    *SM
 3 CL         SE   CE   CS   LU  TB*CD            HF
 2 SI         SC   ZR   SB   RB  Y *BR  AS   CU   CO        TA
 1 AL   NI    BE   FE   CA   TI  SR*ZN  MG   V    MN   EU   NA   YB
---+----+----+----+----+----+----+----+----+----+----+----+----+--
NO<-.6  -.5  -.4  -.3  -.2  -.1   0   0.1  0.2  0.3  0.4  0.5  >.6
```

```
DATA FILE : B:ASONEATA.LOG

LAB A - 50% ORGANICS - NO PREP -
                          AVERAGE

LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

   LI   B    C    N    O    F    P    S    GA   GE
   NB   MO   RU   RH   PD   IN   SN   TE   PR   ND
   GD   DY   HO   ER   TM   RE   OS   IR   PT   AU
   HG   BI


20                                *
19                                *
18                                *
17                                *
16                                *
15                                *
14                                *
13                                *
12                                *
11                                *
10                                *
 9                                *
 8                                *TH
 7                                *W
 6                                *CE
 5                              BA*Y   PB
 4 K                            ZR*SR  LA             TA
 3 CL   U                   TL  AS*BR  SB   HF   CU   EU   YB
 2 SI   AG             SE   LU  NI*ZN  CD   TB   CO   CS   RB
 1 AL   BE        FE   CA   I   SC*TI  MG   SM   MN   CR   NA   V
---+----+----+----+----+----+----+----+----+----+----+----+----+---
NO<-.6  -.5  -.4  -.3  -.2  -.1   0   0.1  0.2  0.3  0.4  0.5  >.6
```

```
DATA FILE : B:ASOPARR.LOG

LAB A - 50% ORGANICS - PB PREP


LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

   LI   B    C    N    O    F    P    S    GA   GE
   NB   MO   RU   RH   PD   IN   SN   TE   PR   ND
   GD   DY   HO   ER   TM   RE   OS   IR   PT   AU
   HG   BI


20                                *
19                                *
18                                *
17                                *
16                                *
15 TA                             *
14 HF                             *
13 LU                             *
12 CS                             *
11 I                              *
10 AG                             *
 9 ZR                             *
 8 BR                             *
 7 ZN                   U         *
 6 NI                   W         *
 5 CR   TH   YB         EU        *
 4 K    CO   SM   CE    SB   PB   *
 3 CL   TI   RB   LA    Y    BA   *
 2 SI   SC   CU   SR    MN   CD  SE*TL
 1 NA   AL   MG   FE    V    CA  AS*TB  BE
 --+----+----+----+----+----+----+----+----+----+----+----+----+--
NO<-.6  -.5  -.4  -.3  -.2  -.1   0  0.1  0.2  0.3  0.4  0.5  >.6
```

```
DATA FILE : B:A9ONEAT1.LOG

LAB A - 90% ORGANICS - NO PREP -
                                RUN 1

LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

   LI    B     C     N     O     F     P     S     GA    GE
   NB    MO    RU    RH    PD    IN    SN    TE    PR    ND
   GD    DY    HO    ER    TM    RE    OS    IR    PT    AU
   HG    BI

20                                      *
19                                      *
18                                      *
17                                      *
16                                      *
15                                      *
14                                      *
13                                      *
12                                      *
11                                      *
10                                      *
 9                                      *TH
 8                                      *TB
 7                                      *LA         W
 6                                      *SR         YB
 5                                    CS*RB         CU
 4                          PB        ZR*BR         MN    LU
 3  I                       TI    CE  FE*ZN         V     SB
 2  AG                U     SI    BA  SC*CA         K     CD          EU    TL
 1  AS    SE    Y     NI    BE    CR  CL*AL   SM    NA    CO    HF    MG    TA
  --+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+--
 NO<-.6  -.5   -.4   -.3   -.2   -.1    0    0.1   0.2   0.3   0.4   0.5   >.6
```

```
DATA FILE : B:A9ONEAT2.LOG


LAB A - 90% ORGANICS - NO PREP -
                          RUN 2


LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

   LI   B    C    N    O    F    P    S    GA   GE
   NB   MO   RU   RH   PD   IN   SN   TE   PR   ND
   GD   DY   HO   ER   TM   RE   OS   IR   PT   AU
   HG   BI



20                                 *
19                                 *
18                                 *
17                                 *
16                                 *
15                                 *
14                                 *
13 TH                              *
12 LA                              *
11 I                               *
10 AG                              *
 9 Y                               *
 8 NI                              *
 7 CO                              *
 6 FE                              *
 5 MN                  EU        U *
 4 CL   BA             CE   YB   SB*
 3 SI   SR   TL   SM   CR   TB   BR*W
 2 AL   TI   ZN   ZR   V    SE   AS*HF      TA   CS
 1 NA   MG   K    CU   BE   CA   SC*LU PB   RB   CD
---+----+----+----+----+----+----+----+----+----+----+----+----+---
NO<-.6  -.5  -.4  -.3  -.2  -.1   0  0.1  0.2  0.3  0.4  0.5  >.6
```

```
DATA FILE : B:A90NEATA.LOG

LAB A - 90% ORGANICS - NO PREP -
                                 AVERAGE

LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

    LI    B     C     N     O     F     P     S     GA    GE
    NB    MO    RU    RH    PD    IN    SN    TE    PR    ND
    GD    DY    HO    ER    TM    RE    OS    IR    PT    AU
    HG    BI


20                                      *
19                                      *
18                                      *
17                                      *
16                                      *
15                                      *
14                                      *
13                                      *
12                                      *
11                                      *
10                                      *
 9                         CE           *
 8                         LA           *PB
 7                         SE           *BR
 6                         AS           *CU
 5                         FE    U      *CO
 4                         CR    TH   TB*MN         W     TL
 3                   BA    CL    ZR   SM*V    YB    LU    HF
 2 I                 TI    AL    SR   SC*K    SB    CS    EU
 1 AG    Y     NI    SI    BE    ZN   CA*NA   RB    MG    CD    TA
 --+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+--
NO<-.6   -.5   -.4   -.3   -.2   -.1    0    0.1   0.2   0.3   0.4   0.5   >.6
```

```
DATA FILE : B:A90PARR.LOG


LAB A - 90% ORGANICS - PB PREP



 ***** OVERFLOW IN HISTOGRAM* ELEMENT TH IN COLUMN LE -0.6 OMITTED
 ***** OVERFLOW IN HISTOGRAM* ELEMENT U IN COLUMN LE -0.6 OMITTED
LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

   LI   B    C    N    O    F    P    S    GA   GE
   NB   MO   RU   RH   PD   IN   SN   TE   PR   ND
   GD   DY   HO   ER   TM   RE   OS   IR   PT   AU
   HG   BI



20 PB                               *
19 CE                               *
18 LA                               *
17 BA                               *
16 CS                               *
15 I                                *
14 AG                               *
13 ZR                               *
12 SR                               *
11 RB                               *
10 SE                               *
 9 NI                               *
 8 CO                               *
 7 FE                               *
 6 CR                               *
 5 V              TA   W            *
 4 TI   EU        HF   SB           *
 3 SC   SM   YB   TB   CD   TL      *
 2 CL   Y    MN   CU   BR   LU      *K
 1 SI   AL   CA   BE   ZN   AS      *NA            MG
 --+----+----+----+----+----+----+----+----+----+----+----+----+--
 NO<-.6  -.5  -.4  -.3  -.2  -.1   0   0.1  0.2  0.3  0.4  0.5  >.6
```

```
DATA FILE : B:BONEAT.LOG

LAB B - 0% ORGANICS - NO PREP


LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

   LI   B    C    N    O    F    P    S    GA   GE
   NB   MO   RU   RH   PD   IN   SN   TE   PR   ND
   GD   DY   HO   ER   TM   RE   OS   IR   PT   AU
   HG   BI


20                                     *
19                                     *
18                                     *
17                                     *
16                                     *
15                                     *
14                                     *
13                                     *
12                                     *
11                                     *
10                                     *
 9                               LU    *
 8                               LA    *
 7                               Y     *PB
 6                               SE    *YB   TH
 5                               AS    *NI   HF
 4                               TI    *CO   SM    TB                      W
 3                               CA    *MN   ZR    EU    BA    TL          TA
 2 AG                      FE    SI  CE*V    ZN    RB    CS    SB          CD
 1 CL    SC    MG    U     NA    AL  I *K    CU    CR    SR    BR          BE
---+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+--
NO<-.6  -.5   -.4   -.3   -.2   -.1    0    0.1   0.2   0.3   0.4   0.5   >.6
```

```
DATA FILE : B:BIONEAT.LOG

LAB B - 10% ORGANICS - NO PREP


LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

    LI    B     C     N     O     F     P     S     GA    GE
    NB    MO    RU    RH    PD    IN    SN    TE    PR    ND
    GD    DY    HO    ER    TM    RE    OS    IR    PT    AU
    HG    BI


20                                       *
19                                       *
18                                       *
17                                       *
16                                       *
15                                       *
14                                       *
13                                       *
12                                       *
11                                       *
10                                       *
 9                                       *
 8                                     U *
 7                                     YB*     TL
 6                                I    SM*     HF
 5                                AG   CE*TH   TB
 4                                Y    LA*EU   SB          CS
 3                          PB    FE   MN*SE   RB          ZR                W
 2                    MG    LU    CA   TI*AS   NI    BA    ZN    SR          CD
 1  CL    AL          NA    SC    SI   K *V    CR    CU    CO    BR    TA    BE
  --+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+--
 NO<-.6   -.5   -.4   -.3   -.2   -.1    0    0.1   0.2   0.3   0.4   0.5   >.6
```

```
DATA FILE : B:B50NEAT.LOG

LAB B - 50% ORGANICS - NO PREP

LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM
   LI   B    C    N    O    F    P    S    GA   GE
   NB   MO   RU   RH   PD   IN   SN   TE   PR   ND
   GD   DY   HO   ER   TM   RE   OS   IR   PT   AU
   HG   BI


20                                *
19                                *
18                                *
17                                *
16                                *
15                                *
14                                *
13                                *
12                                *
11                                *
10                                *
 9                                *
 8                                *
 7                                *
 6                                *    CS                       W
 5                              TH*LU  I    SR   HF             TA
 4                          LA  PB*YB  ZN   CU   EU   TL        CD
 3                          SE  SM*RB  FE   V    BA   TB        BR
 2 AG                       AS  CE*SC  MN   K    NI   SB        CR
 1 CL             Y    U    MG  NA*CA  AL   SI   TI   ZR   CO   BE
---+----+----+----+----+----+----+----+----+----+----+----+----+---
NO<-.6  -.5  -.4  -.3  -.2  -.1   0   0.1  0.2  0.3  0.4  0.5  >.6
```

```
DATA FILE : B:B90LTA.LOG

LAB B - 90% ORGANICS - LTA PREP


LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

   LI   B    C    N    O    F    P    S    GA   GE
   NB   MO   RU   RH   PD   IN   SN   TE   PR   ND
   GD   DY   HO   ER   TM   RE   OS   IR   PT   AU
   HG   BI


20                                       *
19                                       *
18                                       *
17                                       *
16                                       *
15                                       *
14                                       *
13                                       *
12                                       *
11                                       *
10                                       *
 9                                       *
 8                                       *                                   W
 7                                       *                                   TA
 6                                       *TH                                 TB
 5                                       *PB   EU                            CD
 4                                       *RB   SM    LU                      BR
 3 CE                       LA         SE*SI   V     BA    YB          TL    ZN
 2 AG           U           Y     I    MN*AL   TI    CS    CU   HF     ZR    CR
 1 CL           AS    SC    CA    FE   NA*MG   K     SR    NI   SB     CO    BE
----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+--
NO<-.6    -.5   -.4   -.3   -.2   -.1    0    0.1   0.2   0.3   0.4   0.5   >.6
```

```
DATA FILE : B:CONEATA.LOG

LAB C - 0% ORGANICS - NO PREP -
                          AVERAGE

LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

   LI    B     C     N     O     F     AL    P     S     GA
   GE    NB    MO    RU    RH    PD    IN    SN    TE    PR
   ND    GD    DY    HO    ER    TM    TA    RE    OS    IR
   PT    AU    HG    BI


20                                      *
19                                      *
18                                      *
17                                      *
16                                      *
15                                      *
14                                      *
13                                      *
12                                      *U
11                                      *W
10                                      *EU   TH
 9                                      *SM   PB
 8                                      *LA   CS
 7                                      *BA   CD
 6                                      *ZR   ZN
 5                                    LU*Y    CU    HF
 4                               CE   SB*RB   CR    TB
 3                               AG   SE*BR   CA    SR
 2                         I     AS   MN*NI   K     V     TL
 1 BE                SC    FE    CL   TI*CO   SI    MG    YB          NA
---+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+--
NO<-.6   -.5   -.4   -.3   -.2   -.1    0    0.1   0.2   0.3   0.4   0.5   >.6
```

```
DATA FILE : B:CONEATAM.LOG

LAB C - 0% ORGANICS - NO PREP -
                          AMENDED

LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

    LI    B     C     N     O     F     AL    P     S     GA
    GE    NB    MO    RU    RH    PD    IN    SN    TE    PR
    ND    GD    DY    HO    ER    TM    TA    RE    OS    IR
    PT    AU    HG    BI


20                                       *
19                                       *
18                                       *
17                                       *
16                                       *
15                                       *
14                                       *
13                                       *
12                                       *U
11                                       *W
10                                       *EU   TH
 9                                       *SM   PB
 8                                       *LA   CS
 7                                       *BA   CD
 6                                HF     *ZR   ZN
 5                                LU     *Y    CU
 4                                CE   SB*RB   CR    TB
 3                                AG   SE*BR   CA    SR
 2                          I     AS   MN*NI   K     V     TL
 1  BE                SC    FE    CL   TI*CO   SI    MG    YB          NA
 ---+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+--
NO<-. 6   -. 5  -. 4  -. 3  -. 2  -. 1   0    0. 1  0. 2  0. 3  0. 4  0. 5  >. 6
```

```
DATA FILE : B:COPARR.LOG

LAB C - 0% ORGANICS - PB PREP


LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

   LI    B     C     N     O     F     P     S     GA    GE
   NB    MO    RU    RH    PD    IN    SN    TE    PR    ND
   GD    DY    HO    ER    TM    TA    RE    OS    IR    PT
   AU    HG    BI


                                       *
20
19 CE                                  *
18 CS                                  *
17 I                                   *
16 ZR                                  *
15 RB                                  *
14 BR                                  *
13 ZN                                  *
12 NI                                  *
11 CO                                  *
10 CR                                  *
 9 TI                                  *
 8 SC                                  *
 7 K                                   *
 6 CL          HF                      *
 5 SI          LU                      *
 4 AL          LA    PB    TH          *
 3 MG    AG    SB    TL    EU    W     *U
 2 NA    CU    Y     SM    SR    YB    *BA
 1 BE    FE    AS    CA    MN    V     *SE               CD    TB
---+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+---
NO<-.6  -.5   -.4   -.3   -.2   -.1    0    0.1   0.2   0.3   0.4   0.5   >.6
```

```
DATA FILE : B:C1ONEATA.LOG

LAB C - 10% ORGANICS - NO PREP -
                           AVERAGE


LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

   LI   B    C    N    O    F    AL   P    S    GA
   GE   NB   MO   RU   RH   PD   IN   SN   TE   PR
   ND   GD   DY   HO   ER   TM   TA   RE   OS   IR
   PT   AU   HG   BI


20                                *
19                                *
18                                *
17                                *
16                                *
15                                *
14                                *
13                                *
12                                *
11                                *
10                                *
 9                                *
 8                                *
 7                          LU    *   W
 6                          RB    *EU HF
 5                          BR    *CS SM
 4 CL         FE   AG       ZN    *CS LA
 3 SI         SC   AS       CU  SB*ZR CD    U
 2 MG         K    MN       NI  CR*Y  SR    TB   TH
 1 BE         NA   TI   I   CO  V *SE CA    BA   TL         YB   PB
 ---+----+----+----+----+----+----+----+----+----+----+----+----+--
NO<-. 6 -. 5 -. 4 -. 3 -. 2 -. 1  0   0. 1 0. 2 0. 3 0. 4 0. 5 >. 6
```

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```
DATA FILE : B:C1OPARR. LOG

LAB C - 10% ORGANICS - PB PREP


 ***** OVERFLOW IN HISTOGRAM* ELEMENT LA IN COLUMN LE -0. 6 OMITTED
 ***** OVERFLOW IN HISTOGRAM* ELEMENT LU IN COLUMN LE -0. 6 OMITTED
 ***** OVERFLOW IN HISTOGRAM* ELEMENT HF IN COLUMN LE -0. 6 OMITTED
 ***** OVERFLOW IN HISTOGRAM* ELEMENT TL IN COLUMN LE -0. 6 OMITTED
 ***** OVERFLOW IN HISTOGRAM* ELEMENT TH IN COLUMN LE -0. 6 OMITTED
LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

   LI   B    C    N    O    F    P    S    GA   GE
   NB   MO   RU   RH   PD   IN   SN   TE   PR   ND
   GD   DY   HO   ER   TM   TA   RE   OS   IR   PT
   AU   HG   BI


20 CS                             *
19 AG                             *
18 ZR                             *
17 RB                             *
16 BR                             *
15 ZN                             *
14 NI                             *
13 CO                             *
12 FE                             *
11 CR                             *
10 V                              *
 9 TI                             *
 8 SC                             *
 7 K    W                         *
 6 CL   CE                        *
 5 SI   I                         *
 4 AL   SB                        *
 3 MG   Y         U    YB         *
 2 NA   SE        PB   AS   SM    *    TB
 1 BE   MN   CU   EU   CA   SR    *BA  CD
---+----+----+----+----+----+----+----+----+----+----+----+----+--
NO<-. 6 -. 5 -. 4 -. 3 -. 2 -. 1  0   0. 1 0. 2 0. 3 0. 4 0. 5 >. 6
```

```
DATA FILE : B:C50HF.LOG

LAB C - 50% ORGANICS - HFB PREP


LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

   LI    B     C     N     O     F     AL    P     S     GA
   GE    NB    MO    RU    RH    PD    IN    SN    TE    PR
   ND    GD    DY    HO    ER    TM    TA    RE    OS    IR
   PT    AU    HG    BI


20                                            *
19                                            *
18                                            *
17                                            *
16                                            *
15                                            *
14                                            *
13                                            *
12                                            *
11                                            *
10                                            *
 9                                            *
 8                                            *
 7                                            *                  PB
 6                                            *                  TL
 5 I                           W              *                  HF
 4 AG                          LU     CD      *U   Y             YB     EU
 3 BR                          ZN     AS    RB*SB  CU            CE     SM
 2 SI            SE            SC     FE    CA*CO  NI     LA     CS     BA
 1 [illegible]   MG     K      NA     TI    CL*V   CR     MN     ZR     SR     TH     TB
---+------+------+------+------+------+------+------+------+------+------+------+------+---
NO<-.6   -.5    -.4    -.3    -.2    -.1     0     0.1    0.2    0.3    0.4    0.5    >.6
```

```
DATA FILE : B:C50LTA.LOG

LAB C - 50% ORGANICS - LTA PREP


LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

   LI   B    C    N    O    F    AL   P    S    GA
   GE   NB   MO   RU   RH   PD   IN   SN   TE   PR
   ND   GD   DY   HO   ER   TM   RE   OS   IR   PT
   AU   HG   BI


20                                *
19                                *
18                                *
17                                *
16                                *
15                                *
14                                *
13                                *
12                                *
11                                *
10                W               *
 9                SB   CE         *
 8                ZN   LA   U     *
 7                CU   CS   EU    *
 6 TA             NI   Y    SM    *
 5 LU             CO   AS   CD  TH*
 4 I              MN   FE   AG  TL*
 3 SE             TI   V    RB  HF*BA
 2 SC             CL   CA   CR  TB*SR
 1 BE         BR  MG   SI   K   ZR*NA  YB                       PB
 --+----+----+----+----+----+----+----+----+----+----+----+----+--
NO<-.6  -.5  -.4  -.3  -.2  -.1   0   0.1  0.2  0.3  0.4  0.5  >.6
```

```
DATA FILE : B:CSONEATA.LOG

LAB C - 50% ORGANICS - NO PREP -
                          AVERAGE

LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

   LI    B     C     N     O     F     AL    P     S     GA
   GE    RB    NB    MO    RU    RH    PD    IN    SN    TE
   PR    ND    GD    DY    HO    ER    TM    TA    RE    OS
   IR    PT    AU    HG    BI



20                                       *
19                                       *
18                                       *
17                                       *
16                                       *
15                                       *
14                                       *
13                                       *
12                                       *
11                                       *
10                                       *
 9                                       *
 8                                     U *
 7                         W     SM    TL*
 6             TB          LU    SB    EU*
 5 I           SE          CE    CD    CS*
 4 BR          ZN    LA    AG    CU    ZR*
 3 SC          FE    AS    NI    V     Y *
 2 CL          SI    CO    CR    CA    SR*TH       YB
 1 BE          MG    TI    K     NA    MN*PB HF    BA
---+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+---
NO<-.6   -.5   -.4   -.3   -.2   -.1     0   0.1   0.2   0.3   0.4   0.5   >.6
```

```
DATA FILE : B:C50PARR.LOG

LAB C - 50% ORGANICS - PB PREP


 ***** OVERFLOW IN HISTOGRAM* ELEMENT Y IN COLUMN LE -0.6 OMITTED
 ***** OVERFLOW IN HISTOGRAM* ELEMENT ZR IN COLUMN LE -0.6 OMITTED
 ***** OVERFLOW IN HISTOGRAM* ELEMENT I IN COLUMN LE -0.6 OMITTED
 ***** OVERFLOW IN HISTOGRAM* ELEMENT CS IN COLUMN LE -0.6 OMITTED
 ***** OVERFLOW IN HISTOGRAM* ELEMENT LA IN COLUMN LE -0.6 OMITTED
 ***** OVERFLOW IN HISTOGRAM* ELEMENT CE IN COLUMN LE -0.6 OMITTED
 ***** OVERFLOW IN HISTOGRAM* ELEMENT SM IN COLUMN LE -0.6 OMITTED
 ***** OVERFLOW IN HISTOGRAM* ELEMENT EU IN COLUMN LE -0.6 OMITTED
 ***** OVERFLOW IN HISTOGRAM* ELEMENT TH IN COLUMN LE -0.6 OMITTED
LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

    LI    B     C     N     O     F     P     S     GA    GE
    NB    MO    RU    RH    PD    IN    SN    TE    PR    ND
    GD    DY    HO    ER    TM    TA    RE    OS    IR    PT
    AU    HG    BI



20 RB                                  *
19 BR                                  *
18 AS                                  *
17 ZN                                  *
16 CU                                  *
15 CO                                  *
14 FE                                  *
13 MN                                  *
12 CR                                  *
11 V                                   *
10 TI                                  *
 9 SC                                  *
 8 CA                                  *
 7 K                                   *
 6 CL                                  *
 5 SI    TL                            *
 4 AL    HF          U                 *
 3 MG    LU          PB                *
 2 NA    SB    YB    BA    W           *
 1 BE    AG    NI    SR    SE        CD*TB
----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+---
NO<-.6  -.5   -.4   -.3   -.2   -.1    0    0.1   0.2   0.3   0.4   0.5   >.6
```

```
DATA FILE : B:C90LTA.LOG

LAB C - 90% ORGANICS - LTA PREP


LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

   LI    B     C     N     O     F     AL    P     S     GA
   GE    NB    MO    RU    RH    PD    IN    SN    TE    PR
   ND    GD    DY    HO    ER    TM    RE    OS    IR    PT
   AU    HG    BI


20                                       *
19                                       *
18                                       *
17                                       *
16                                       *
15                                       *
14                                       *
13                                       *
12                                       *
11                                       *
10                                       *
 9                                       *
 8 TA                                    *
 7 I                                     *   TH
 6 AG                             HF    CE*U  TL
 5 SC                             SB    LA*W  BA
 4 CL                       TB    CU    ZR*LU CS
 3 SI                       RB    NI    MN*EU CD
 2 MG          SE    FE     ZN    CO    V *SM Y
 1 BE    BR    AS    K      NA    CR    TI*CA SR          PB          YB
---+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+---
NO<-.6   -.5   -.4   -.3   -.2   -.1    0    0.1   0.2   0.3   0.4   0.5   >.6
```

```
DATA FILE : B:C90PARR.LOG

LAB C - 90% ORGANICS - PB PREP


 ***** OVERFLOW IN HISTOGRAM* ELEMENT CS IN COLUMN LE -0.6 OMITTED
 ***** OVERFLOW IN HISTOGRAM* ELEMENT BA IN COLUMN LE -0.6 OMITTED
 ***** OVERFLOW IN HISTOGRAM* ELEMENT LA IN COLUMN LE -0.6 OMITTED
 ***** OVERFLOW IN HISTOGRAM* ELEMENT CE IN COLUMN LE -0.6 OMITTED
 ***** OVERFLOW IN HISTOGRAM* ELEMENT SM IN COLUMN LE -0.6 OMITTED
 ***** OVERFLOW IN HISTOGRAM* ELEMENT PB IN COLUMN LE -0.6 OMITTED
 ***** OVERFLOW IN HISTOGRAM* ELEMENT TH IN COLUMN LE -0.6 OMITTED
 ***** OVERFLOW IN HISTOGRAM* ELEMENT U IN COLUMN LE -0.6 OMITTED
LISTING OF ELEMENTS NOT INCLUDED IN HISTOGRAM

   LI    B     C     N     O     F     P     S     GA    GE
   NB    MO    RU    RH    PD    IN    SN    TE    PR    ND
   GD    DY    HO    ER    TM    TA    RE    OS    IR    PT
   AU    HG    BI


20 I                                    *
19 AG                                   *
18 ZR                                   *
17 Y                                    *
16 SR                                   *
15 RB                                   *
14 CU                                   *
13 CO                                   *
12 FE                                   *
11 MN                                   *
10 CR                                   *
 9 V                                    *
 8 TI                                   *
 7 SC                                   *
 6 CA                                   *
 5 K                                    *
 4 CL                                   *     W
 3 SI     TL    TB          EU          *     HF
 2 MG     CD    SB    AS    BR          *     LU
 1 BE     AL    SE    ZN    NI          *NA   YB
 ---+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+---
 NO<-.6   -.5   -.4   -.3   -.2   -.1   0    0.1   0.2   0.3   0.4   0.5   >.6
```